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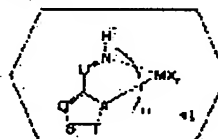
FUJITA TERUNORI

(54) α -OLEFIN/CYCLIC OLEFIN COPOLYMER AND ITS MANUFACTURING METHOD**(57)Abstract:**

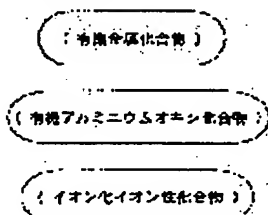
PROBLEM TO BE SOLVED: To obtain an α -olefin/cyclic olefin copolymer having a very narrow molecular weight distribution, and to provide a method for manufacturing this α -olefin/cyclic olefin copolymer with high polymerization activity.

SOLUTION: The α -olefin/cyclic olefin copolymer consists of (A) at least one constituting unit selected from the group consisting of 2-30C linear or branched α -olefins and (B) at least one constituting unit selected from the group consisting of cyclic olefin-derived constituting units and has (a) an Mw/Mn obtained by GPC of $1.0 < (Mw/Mn) \leq 1.8$, (b) a weight average molecular weight (Mw) of $1,000 \leq Mw \leq 5,000,000$, and simultaneously, (c) a molar ratio of the constituting unit derived from the α -olefin to that derived from the cyclic olefin of 99/1 to 20/80.

(A) 直鎖炭化水素成分



(B) 環状炭化水素成分



(C) 第二成分

(図 1)

α -オレフィン・環状
オレフィン共重合体

n : 11 以下の原子数
 m : 2-11 以下の原子数
 R^1 : H, N, P
 R^2 : H, N, P
 R^3 : H, N, P
 R^4 : H, N, P
 R^5 : H, N, P
 R^6 : H, N, P
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2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to an alpha olefin and an annular olefine copolymer with very narrow molecular weight distribution, and its manufacture approach in more detail about an alpha olefin, an annular olefine copolymer, and its manufacture approach.

[0002]

[Background of the Invention] The annular olefin system copolymer which is made to carry out copolymerization of an alpha olefin and the specific annular olefin, and is obtained is excellent in an optical property, a mechanical characteristic, a heat characteristic, etc., and moreover, since these balance is good, it is used as optical materials, such as an optical memory disk and an optical fiber.

[0003] Such an annular olefin system copolymer is manufactured by carrying out copolymerization of an alpha olefin and the specific annular olefin by using the inside of hydrocarbon solvents, such as toluene, a cyclohexane, a hexane, and a heptane, or the annular olefin itself as a solvent to the bottom of existence of the vanadium system catalyst conventionally formed from a fusibility vanadium compound and an organoaluminium compound. However, such a vanadium system catalyst had low polymerization activity, and it was difficult to obtain an annular olefin system copolymer by high yield. Moreover, the annular olefin system copolymer obtained had large molecular weight distribution, presentation distribution's was uneven, and had the trouble of many alpha olefin components of the amount of macromolecules generating.

[0004] On the other hand, it is shown in JP,61-221206,A, JP,5-9223,A, JP,5-320258,A, JP,8-3230,A, etc. that the catalyst which consists of a metallocene and alumino oxan is excellent in the polymerization activity over an annular olefin. However, the polymer which has uniform presentation distribution is obtained rather than the catalyst which consists of such a zirconium compound and alumino oxan is a single site catalyst, the polymer obtained has a narrow molecular weight distribution and it is obtained with a vanadium system catalyst, but the incorporation effectiveness of an annular olefin is bad, and in order to obtain the target annular olefine copolymer, there is a trouble that an annular olefin must be taught so much. Moreover, this catalyst has the problem of being very expensive.

[0005] For this reason, the alpha olefin and the specific annular olefin could be copolymerized in high polymerization activity, and an appearance of the manufacture approach of the cheap catalyst which can moreover manufacture an annular olefin system copolymer with very narrow molecular weight distribution and such an annular olefin system copolymer, and an annular olefin system copolymer was desired. As a result of this invention persons' inquiring in view of the above conventional techniques, the catalyst which consists of at least one sort of compounds chosen from the compound which reacts with a specific transition-metals compound, and an organometallic compound, an organic aluminum oxy compound or a transition-metals compound, and forms an ion pair is excellent in the copolymerization activity of an alpha olefin and an annular olefin, and, moreover, came to complete header this invention for giving a copolymer with narrow molecular weight distribution.

[0006]

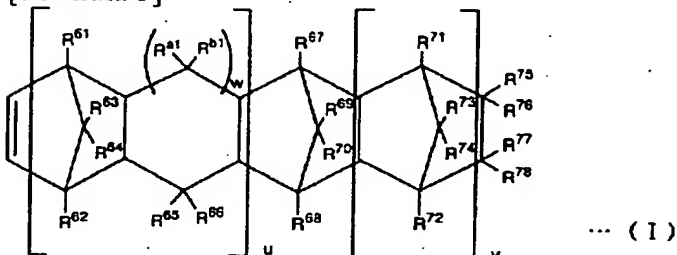
[Objects of the Invention] Namely, it aims at offering the approach of manufacturing such an alpha olefin and an annular olefine copolymer in high polymerization activity while molecular weight distribution aim this invention at offering very narrow alpha olefin and annular olefine copolymer.

[0007]

[Summary of the Invention] The alpha olefin and annular olefine copolymer concerning this invention are [the configuration unit to which (A) carbon atomic number originates in the alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, and] the (B) following general formula (I).

[0008]

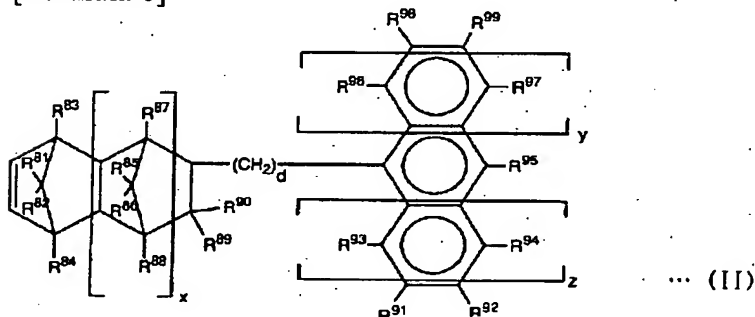
[Formula 5]



[0009] (u is 0 or 1 among a formula (I), v is 0 or a forward integer, and w is 0 or 1. R61-R78, and Ra1 and Rb1) You may differ, even if mutually the same, and they are a hydrogen atom, a halogen atom, or a hydrocarbon group. R75-R78 It may join together mutually, and a monocycle or many rings may be formed, and this monocycle or many rings may have the double bond. By R75 and R76 [moreover,] R77 and R78 -- an alkylidene radical -- forming -- **** -- the configuration unit originating in the annular olefin expressed, and the following general formula (II) [or]

[0010]

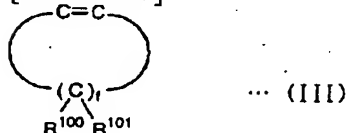
[Formula 6]



[0011] (x and d are 0 or one or more integers among a formula (II), and y and z are 0, 1, or 2. R81-R99) The carbon atom which you may differ even if mutually the same, and is a hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an aromatic hydrocarbon radical, or an alkoxy group, and R89 and R90 have combined, With the carbon atom which the carbon atom which R93 has combined, or R91 has combined You may join together through the alkylene group of the direct or carbon atomic numbers 1-3. At moreover, the time of y=z=0 R95, R92, or R95 and R99 -- mutual -- joining together -- the aromatic series ring of a monocycle or many rings -- forming -- **** -- the configuration unit originating in the annular olefin expressed, and the following general formula (III)

[0012]

[Formula 7]



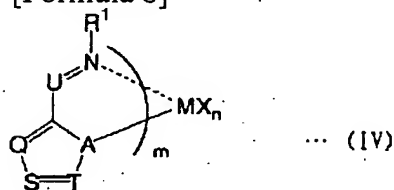
[0013] (Among the formula (III), even if R100 and R101 are mutually the same, you may differ.) it is the hydrocarbon group of a hydrogen atom or the carbon atomic numbers 1-5, and f is $1 \leq f \leq 18$. They are the alpha olefin and annular olefine copolymer which consists of at least one sort of configuration units chosen from the group which consists of a configuration unit originating in the annular olefin expressed. (a) The ratio (Mw/Mn) of the weight average molecular weight (Mw) measured with gel permeation chromatography (GPC) and number average molecular weight (Mn) is

1.0 < (Mw/Mn) ≤ 1.8. (b) The configuration unit which the weight average molecular weight (Mw) measured with gel permeation chromatography (GPC) is 1,000 ≤ Mw ≤ 5,000,000, and originates in the (c) alpha olefin, It is characterized by the range of a mole ratio (an alpha olefin / annular olefin) with the configuration unit originating in an annular olefin being 99 / 1 - 20/80.

[0014] The alpha olefin and annular olefine copolymer concerning this invention (A) carbon atomic number For example, the alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, (B) The annular olefin expressed with the annular olefin expressed with the above-mentioned general formula (I), and the above-mentioned general formula (II), And the transition-metals compound expressed with the (C) following general formula (IV) in at least one sort of annular olefins chosen from the group which consists of an annular olefin expressed with the above-mentioned general formula (III), (D) (D-1) An organometallic compound, an organic (D-2) aluminum oxy compound, And (D-3) they are the alpha olefin and annular olefine copolymer obtained by copolymerizing under existence of the catalyst for olefin polymerization which consists of at least one sort of compounds chosen from the compound which reacts with a transition-metals compound (C) and forms an ion pair.

[0015]

[Formula 8]



[0016] (M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table. U) The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R2 is shown. A A nitrogen atom or the Lynn atom is shown and Q shows the carbon atom, nitrogen atom, or the Lynn atom which has a substituent R3. S The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R4 is shown. T The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R5 is shown. m At the time of the transition-metals atom with which the integer of 2-6 is shown, you may differ even if R1-R5 are mutually the same, and M is chosen from the 3-5th groups of a periodic table, and the 7-11th groups A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, At the time of the transition-metals atom with which a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown, and M is chosen from the 6th group of a periodic table R1 A hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an alicycle group hydrocarbon group, Heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. R2-R5 A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, A nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. R1-R5 One of R1-R5 which may connect mutually [two or more pieces] of these, may form the ring, and are contained in any one ligand radicals A joint radical or single bond may be formed by one of R1-R5 which are contained in other ligands radicals. n It is the number which fills the valence of M. X A hydrogen atom, a halogen atom, a hydrocarbon group, An oxygen content radical, a sulfur content radical, a nitrogen content radical, a boron content radical, an aluminum content radical, The Lynn content radical, a halogen content radical, heterocyclic compound residue, a silicon content radical, a germanium content radical, or a tin content radical is shown, and when n is two or more two or more radicals which may differ even if two or more radicals shown by X are mutually the same, and are shown by X may be connected mutually, and may form a ring. .

[0017] the alpha olefin and annular olefine copolymer concerning this invention -- the above-mentioned alpha olefin -- ethylene -- it is -- the above-mentioned annular olefin -- a bicyclo [2.2.1] hept-2-en and/or tetracyclo [-- 4. -- it is desirable that they are 4.0.12, 5.17, and 10]-3-dodecen. The

manufacture approach of the alpha olefin and annular olefine copolymer concerning this invention (A) A carbon atomic number The alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, (B) The annular olefine expressed with the annular olefine expressed with the above-mentioned general formula (I), and the above-mentioned general formula (II), And the transition-metals compound expressed with the (C) above-mentioned general formula (IV) in at least one sort of annular olefins chosen from the group which consists of an annular olefine expressed with the above-mentioned general formula (III), (D) (D-1) An organometallic compound, an organic (D-2) aluminum oxy compound, And (D-3) it is characterized by copolymerizing under existence of the catalyst for olefin polymerization which consists of at least one sort of compounds chosen from the compound which reacts with a transition-metals compound (C) and forms an ion pair.

[0018] the manufacture approach of the alpha olefin and annular olefine copolymer concerning this invention -- the above-mentioned alpha olefin -- ethylene -- it is -- the above-mentioned annular olefine -- a bicyclo [2.2.1] hept-2-en and/or tetracyclo [-- 4. -- it is desirable that they are 4.0.12, 5.17, and 10]-3-dodecen. It is desirable to manufacture the alpha olefin and annular olefine copolymer which fills the requirements for the above (a), (b), and (c) with the manufacture approach of the alpha olefin and annular olefine copolymer concerning this invention.

[0019]

[Detailed Description of the Invention] Hereafter, the alpha olefin and annular olefine copolymer in this invention, and its manufacture approach are explained concretely. The alpha olefin and annular olefine copolymer concerning this invention (A) The configuration unit to which a carbon atomic number originates in the alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, (B) The configuration unit originating in the annular olefine expressed with the following general formula (I), It consists of at least one sort of configuration units chosen from the group which consists of a configuration unit originating in the annular olefine expressed with the following general formula (II), and a configuration unit originating in the annular olefine expressed with the following general formula (III).

[0020] First, these alpha olefins and an annular olefine are explained.

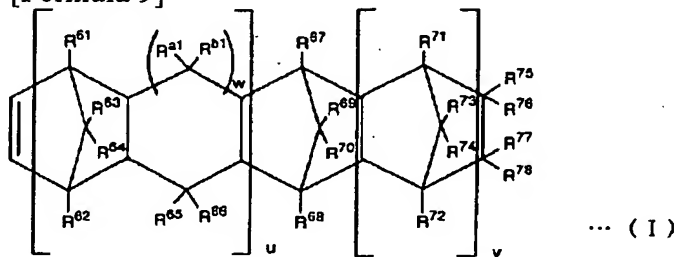
(A) The configuration unit (A) originating in the alpha olefin which forms the alpha olefin and annular olefine copolymer concerning configuration unit this invention originating in an alpha olefin is a configuration unit to which the following carbon atomic numbers originate in the alpha olefin of the shape of a straight chain of 2-30, and the letter of branching.

[0021] A carbon atomic number as an alpha olefin of the shape of a straight chain of 2-30, and the letter of branching specifically Ethylene, a propylene, 1-butene, 1-pentene, 1-hexene, A 3-methyl-1-butene, 3-methyl-1-pentene, 3-ethyl-1-pentene, A 4-methyl-1-pentene, 4-methyl-1-hexene, 4, and 4-dimethyl-1-hexene, 4 and 4-dimethyl-1-pentene, a 4-ethyl-1-hexene, a 3-ethyl-1-hexene, 1-octene, 1-decene, 1-dodecen, 1-tetra-decene, 1-hexa decene, 1-octadecene, 1-ray KOSEN, etc. are mentioned. In these, ethylene and a propylene are desirable and especially ethylene is desirable. Two or more sorts of configuration units originating in these alpha olefins may be included.

[0022] (B) The configuration unit (B) originating in the annular olefine which forms the alpha olefin and annular olefine copolymer concerning configuration unit this invention originating in an annular olefine is a configuration unit originating in the following general formula (I), (II), or (III) the annular olefine expressed. First, the annular olefine expressed with a general formula (I) is explained.

[0023]

[Formula 9]



[0024] u is 0 or 1 among a formula (I), v is 0 or a forward integer, and w is 0 or 1. In addition, the ring expressed using w when w is 1 turns into six membered-rings, and when w is 0, this ring turns

into five membered-rings. Even if R61-R78, and Ra1 and Rb1 are mutually the same, they may differ from each other, and it is a hydrogen atom, a halogen atom, or a hydrocarbon group.

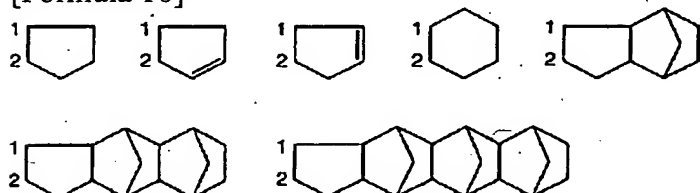
[0025] Here, a halogen atom is a fluorine atom, a chlorine atom, a bromine atom, or an iodine atom. Moreover, as a hydrocarbon group, the alkyl group of the carbon atomic numbers 1-20, the alkyl halide radical of the carbon atomic numbers 1-20, the cycloalkyl radical of the carbon atomic numbers 3-15, or an aromatic hydrocarbon radical is usually mentioned.

[0026] More specifically as an alkyl group, methyl, ethyl, propyl, isopropyl, amyl, hexyl, octyl, DESHIRU, dodecyl, octadecyl, etc. are mentioned. As an alkyl halide radical, the radical which one piece or two or more halogen atoms permuted by the alkyl group of the above-mentioned carbon atomic numbers 1-20 is mentioned.

[0027] As a cycloalkyl radical, cyclohexyl etc. is mentioned and phenyl, naphthyl, etc. are mentioned as an aromatic hydrocarbon radical. Furthermore, it sets to the above-mentioned general formula (I). R75 and R76 R77 and R78 The monocycle or many rings which were formed by R75, R78, or R76 and R77 joining together, respectively (working together mutually), and R76 and R78 forming the radical of a monocycle or many rings, and R75 and R77 doing in this way may have the double bond. As the monocycle formed here or many rings, the following is mentioned concretely.

[0028]

[Formula 10]

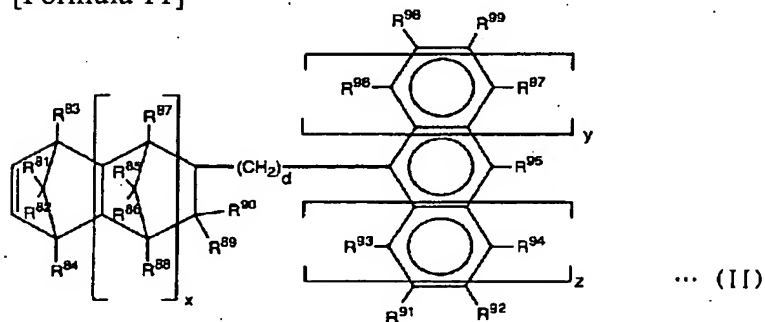


[0029] In addition, in the above-mentioned instantiation, the carbon atom which attached the number of 1 or 2 expresses the carbon atom which R75 (R76) or R77 (R78) have combined in the above-mentioned general formula (I), respectively. Moreover, it is with R75 and R76, or the alkylidene radical may be formed by R77 and R78. Such an alkylidene radical is usually an alkylidene radical of the carbon atomic numbers 2-20, and ethylidene, propylidene, isopropylidene, etc. are mentioned as a concrete example of such an alkylidene radical.

[0030] Next, the annular olefin expressed with a general formula (II) is explained.

[0031]

[Formula 11]



[0032] x and d are 0 or a forward integer among a formula (II), and y and z are 0, 1, or 2. R81-R99 -- ** -- you may differ, even if mutually the same, and they are a hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an aromatic hydrocarbon radical, or an alkoxy group. [moreover,] As a halogen atom, the same thing as the halogen atom in the above-mentioned formula (I) can be illustrated.

[0033] Moreover, as an aliphatic hydrocarbon radical, the alkyl group of the carbon atomic numbers 1-20 or the cycloalkyl radical of the carbon atomic numbers 3-15 is mentioned. More specifically as an alkyl group, methyl, ethyl, propyl, isopropyl, amyl, hexyl, octyl, DESHIRU, dodecyl, octadecyl, etc. are mentioned.

[0034] Cyclohexyl etc. is mentioned as a cycloalkyl radical. As an aromatic hydrocarbon radical, an

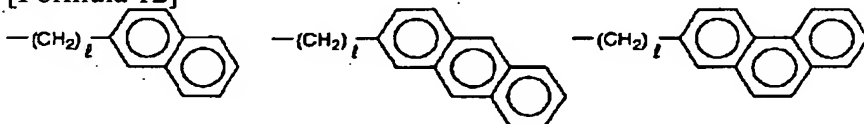
aryl group, an aralkyl radical, etc. are mentioned and, specifically, phenyl, tolyl, naphthyl, benzyl, phenylethyl, etc. are mentioned. Methoxy and ethoxy ** pro HOKISHI etc. is mentioned as an alkoxy group.

[0035] Here, the carbon atom which R89 and R90 have combined, and the carbon atom which the carbon atom which R93 has combined, or R91 has combined may be combined through the alkylene group of the direct or carbon atomic numbers 1-3. Namely, when the two above-mentioned carbon atoms have joined together through an alkylene group, R89, R93, or R90 and R91 form the alkylene group of the methylene group (-CH₂-), ethylene (-CH₂CH₂-), or the propylene radicals (-CH₂CH₂CH₂-) jointly mutually.

[0036] Furthermore, at the time of $y=z=0$, it may join together mutually and R95, R92, or R95 and R99 may form the aromatic series ring of a monocycle or many rings. Specifically, the following aromatic series rings formed of R95 and R92 are mentioned at the time of $y=z=0$.

[0037]

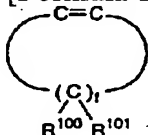
[Formula 12]



[0038] Here, l is the same as d in the above-mentioned general formula (II). Next, it is expressed with a general formula (III) and annular olefin ***** explanation is given.

[0039]

[Formula 13]



[0040] Among the formula (III), even if R100 and R101 are mutually the same, you may differ, and it is the hydrocarbon group of a hydrogen atom or the carbon atomic numbers 1-5, and f is $1 \leq f \leq 18$. An alkyl group, an alkyl halide radical, or a cycloalkyl radical can be mentioned preferably as a hydrocarbon group of the carbon atomic numbers 1-5. Probably, these examples will be clear from the example of R61-R78 of the above-mentioned formula (I).

[0041] As the above general formulas (I), (II), or (III) an annular olefin expressed Specifically A bicyclo-2-heptene derivative (bicyclo hept-2-en derivative), A tricyclo-3-decene derivative, a tricyclo-3-undecene derivative, A tetracyclo-3-dodecen derivative, a PENTA cyclo-4-pentadecene derivative, A pentacyclo pentadecadiene derivative, a PENTA cyclo-3-pentadecene derivative, A PENTA cyclo-4-hexa decene derivative, a PENTA cyclo-3-hexa decene derivative, A hexa cyclo-4-heptadecene derivative, a heptacyclo-5-ray KOSEN derivative, A heptacyclo-4-ray KOSEN derivative, a heptacyclo-5-HENEIKOSEN derivative, An octacyclo-5-DOKOSEN derivative, a nonacyclo-5-pen TAKOSEN derivative, A nonacyclo-6-hexa KOSEN derivative, a cyclopentadiene-acenaphthylene addition product, 1, 4-methano - 1, 4, 4a, a 9a-tetrahydro fluorene derivative, 1, 4-methano - A 1, 4, a [4], 5, 10, and 10a-hexahydro anthracene derivative, the cyclo alkylene derivative of carbon numbers 3-20, etc. are mentioned.

[0042] Below, a up Norikazu type (I), (II), or (III) the concrete example of an annular olefin expressed is shown.

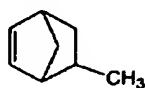
[0043]

[Formula 14]

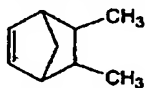
ビシクロ [2.2.1] ヘプト-2-エン



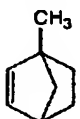
5-メチルビシクロ [2.2.1] ヘプト-2-エン



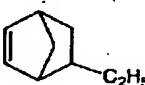
5,6-ジメチルビシクロ [2.2.1] ヘプト-2-エン



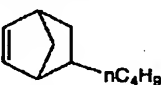
1-メチルビシクロ [2.2.1] ヘプト-2-エン



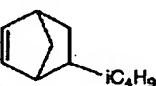
5-エチルビシクロ [2.2.1] ヘプト-2-エン



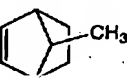
5-n-ブチルビシクロ [2.2.1] ヘプト-2-エン



5-イソブチルビシクロ [2.2.1] ヘプト-2-エン



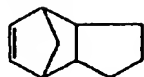
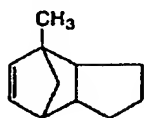
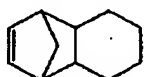
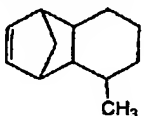
7-メチルビシクロ [2.2.1] ヘプト-2-エン



などのビシクロ [2.2.1] ヘプト-2-エン誘導体；

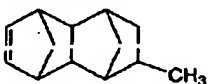
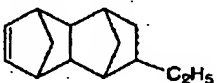
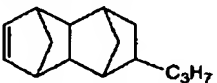
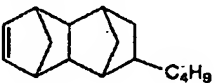
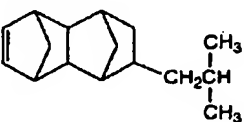
[0044]

[Formula 15]

トリシクロ [4.3.0.1^{2,5}] -3-デセン2-メチルトリシクロ [4.3.0.1^{2,5}] -3-デセンなどのトリシクロ [4.3.0.1^{2,5}] -3-デセン誘導体；トリシクロ [4.4.0.1^{2,5}] -3-ウンデセン7-メチルトリシクロ [4.4.0.1^{2,5}] -3-ウンデセンなどのトリシクロ [4.4.0.1^{2,5}] -3-ウンデセン誘導体；

[0045]

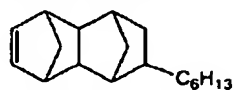
[Formula 16]

テトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン8-メチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン8-エチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン8-プロピルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン8-ブチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン8-イソブチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン

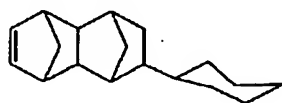
[0046]

[Formula 17]

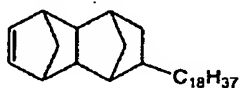
8-ヘキシルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



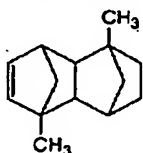
8-シクロヘキシルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



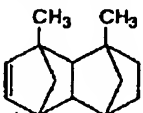
8-ステアリルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



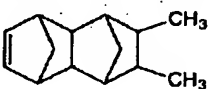
5,10-ジメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



2,10-ジメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



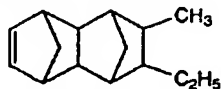
8,9-ジメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



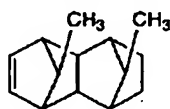
[0047]

[Formula 18]

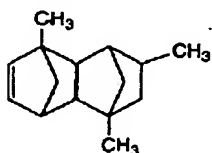
8-エチル-9-メチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



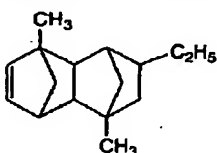
11,12-ジメチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



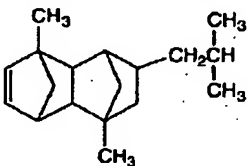
2,7,9-トリメチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



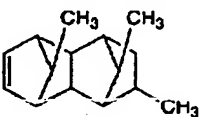
2,7-ジメチル-9-エチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



9-イソブチル-2,7-ジメチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



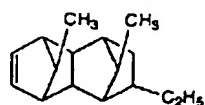
8,11,12-トリメチルトetraシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



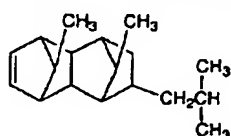
[0048]

[Formula 19]

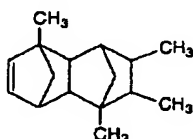
8-エチル-11,12-ジメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



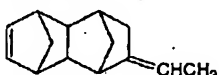
8-イソブチル-11,12-ジメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



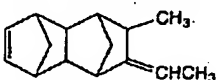
2,7,8,9-テトラメチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



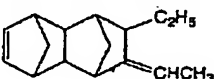
8-エチリデンテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



8-エチリデン-9-メチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



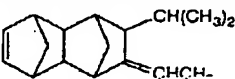
8-エチリデン-9-エチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



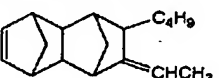
[0049]

[Formula 20]

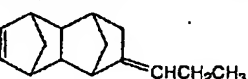
8-エチリデン-9-イソプロピルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



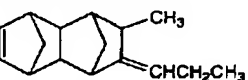
8-エチリデン-9-ブチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



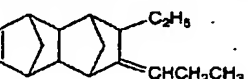
8-n-プロピリデンテトラシクロシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



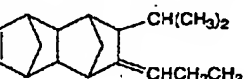
8-n-プロピリデン-9-メチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



8-n-プロピリデン-9-エチルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



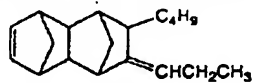
8-n-プロピリデン-9-イソプロピルテトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン



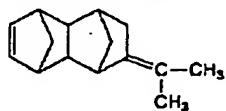
[0050]

[Formula 21]

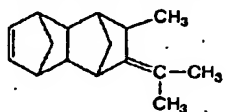
8- α -プロピリデン-9-ブチルテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



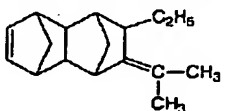
8-イソプロピリデンテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



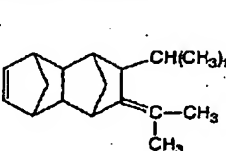
8-イソプロピリデン-9-メチルテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



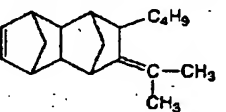
8-イソプロピリデン-9-エチルテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



8-イソプロピリデン-9-イソプロピルテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



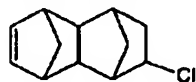
8-イソプロピリデン-9-ブチルテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



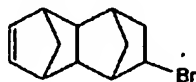
[0051]

[Formula 22]

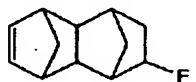
8-クロロテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



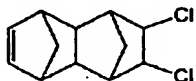
8-ブロモテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



8-フルオロテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン

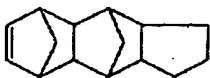


8, 9-ジクロロテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン

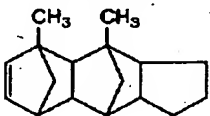


などのテトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン誘導体 ;

ペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン



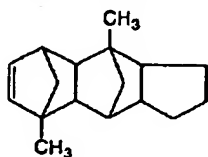
1, 3-ジメチルペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン



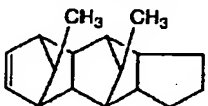
[0052]

[Formula 23]

1, 6-ジメチルペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン

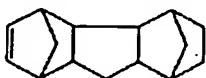


14, 15-ジメチルペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン

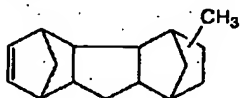


などのペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン誘導体；

ペンタシクロ [7. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ペンタデセン

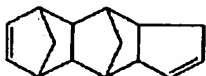


メチル置換ペンタシクロ [7. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ペンタデセン



などのペンタシクロ [7. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ペンタデセン誘導体；

ペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4, 10-ペンタデカジエン

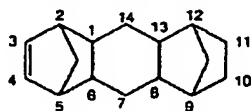


などのペンタシクロペンタデカジエン化合物；

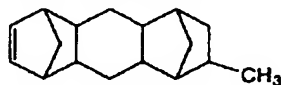
[0053]

[Formula 24]

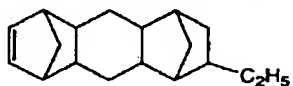
ペンタシクロ [8. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ヘキサデセン



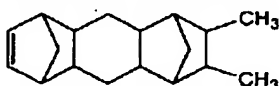
10-メチル-ペンタシクロ [8. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ヘキサデセン



10-エチル-ペンタシクロ [8. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ヘキサデセン

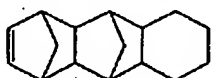


10, 11-ジメチル-ペンタシクロ [8. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ヘキサデセン

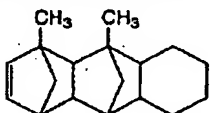


などのペンタシクロ [8. 4. 0. 1^{2,5}. 1^{9,12}. 0^{8,13}] -3-ヘキサデセン誘導体；

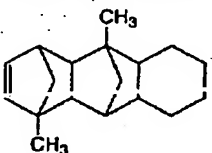
ペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン



1, 3-ジメチルペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン



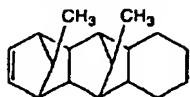
1, 6-ジメチルペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン



[0054]

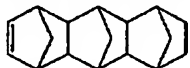
[Formula 25]

15, 16-ジメチルペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン

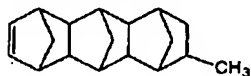


などのペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン誘導体 ;

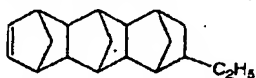
ヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン



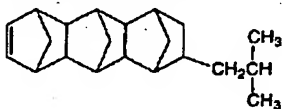
11-メチルヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン



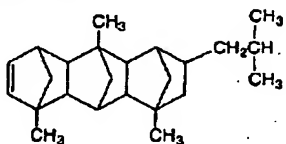
11-エチルヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン



11-イソブチルヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン



1, 6, 10-トリメチル-12-イソブチルヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン

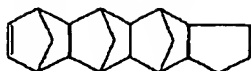


などのヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン誘導体 ;

[0055]

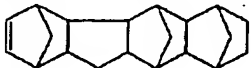
[Formula 26]

ヘプタシクロ [8.7.0.1^{2,9}.1^{4,7}.1^{11,17}.0^{3,8}.0^{12,16}] -5-エイコセン

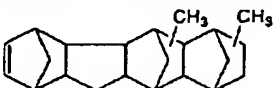


などのヘプタシクロ-5-エイコセン誘導体；

ヘプタシクロ [8.7.0.1^{3,6}.1^{10,17}.1^{12,15}.0^{2,7}.0^{11,16}] -4-エイコセン

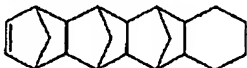


ジメチル置換ヘプタシクロ [8.7.0.1^{3,6}.1^{10,17}.1^{12,15}.0^{2,7}.0^{11,16}] -4-エイコセン

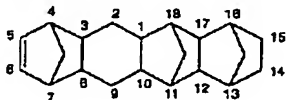


などのヘプタシクロ [8.7.0.1^{3,6}.1^{10,17}.1^{12,15}.0^{2,7}.0^{11,16}] -4-エイコセン誘導体

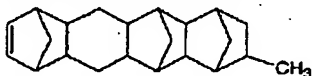
ヘプタシクロ [8.8.0.1^{2,9}.1^{4,7}.1^{11,18}.0^{3,8}.0^{12,17}] -5-ヘンエイコセン



ヘプタシクロ [8.8.0.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ヘンエイコセン



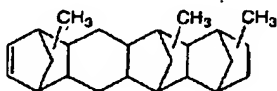
14-メチル-ヘプタシクロ [8.8.0.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ヘンエイコセン



[0056]

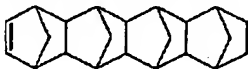
[Formula 27]

トリメチル置換ヘプタシクロ [8.8.0.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ヘンエイコセン

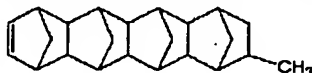


などのヘプタシクロ-5-ヘンエイコセン誘導体；

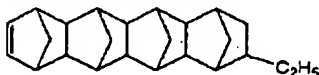
オクタシクロ [8.8.0.1^{2,9}.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ドコセン



14-メチルオクタシクロ [8.8.0.1^{2,9}.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ドコセン



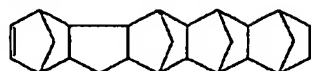
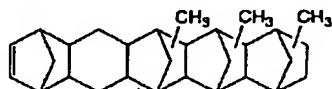
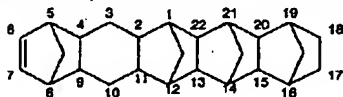
14-エチルオクタシクロ [8.8.0.1^{2,9}.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ドコセン



などのオクタシクロ [8.8.0.1^{2,9}.1^{4,7}.1^{11,18}.1^{13,16}.0^{3,8}.0^{12,17}] -5-ドコセン誘導体；

[0057]

[Formula 28]

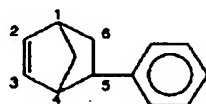
ノナシクロ [10, 9, 1, 1^{4,7}, 1^{13,20}, 1^{15,18}, 0^{2,10}, 0^{3,8}, 0^{12,21}, 0^{14,19}] -5-ペンタコセントリメチル置換ノナシクロ [10, 9, 1, 1^{4,7}, 1^{13,20}, 1^{15,18}, 0^{2,10}, 0^{3,8}, 0^{12,21}, 0^{14,19}] -5-ペンタコセンなどのノナシクロ [10, 9, 1, 1^{4,7}, 1^{13,20}, 1^{15,18}, 0^{2,10}, 0^{3,8}, 0^{12,21}, 0^{14,19}] -5-ペンタコセン誘導体；ノナシクロ [10, 10, 1, 1^{5,8}, 1^{14,21}, 1^{16,19}, 0^{2,11}, 0^{4,9}, 0^{13,22}, 0^{15,20}] -6-ヘキサコセンなどのノナシクロ [10, 10, 1, 1^{5,8}, 1^{14,21}, 1^{16,19}, 0^{2,11}, 0^{4,9}, 0^{13,22}, 0^{15,20}] -6-ヘキサコセン誘導体；

[0058]

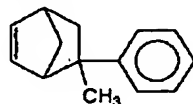
[Formula 29]

そしてさらには、

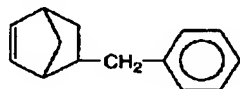
5-フェニル-ビスクロ [2.2.1] ヘプト-2-エン



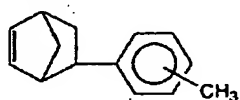
5-メチル-5-フェニル [2.2.1] ヘプト-2-エン



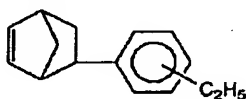
5-ベンジル-ビスクロ [2.2.1] ヘプト-2-エン



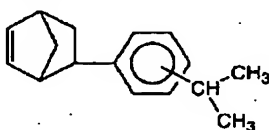
5-トリル-ビスクロ [2.2.1] ヘプト-2-エン



5-(エチルフェニル)-ビスクロ [2.2.1] ヘプト-2-エン



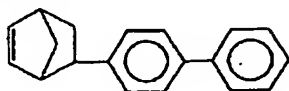
5-(イソプロピルフェニル)-ビスクロ [2.2.1] ヘプト-2-エン



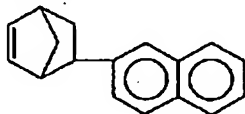
[0059]

[Formula 30]

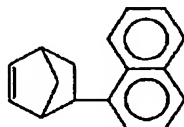
5-(ビフェニル)-ビスクロ [2.2.1] ヘプト-2-エン



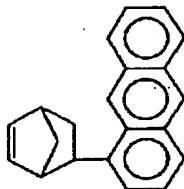
5-(β -ナフチル)-ビスクロ [2.2.1] ヘプト-2-エン



5-(α -ナフチル)-ビスクロ [2.2.1] ヘプト-2-エン



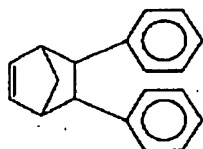
5-(アントラセニル)-ビスクロ [2.2.1] ヘプト-2-エン



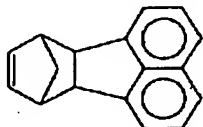
<TXF FR=0001 HE=010 WI=080 LX=1100 LY=0300> [0060]

[Formula 31]

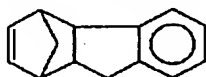
5,6-ジフェニル-ビスクロ [2.2.1] ヘプト-2-エン



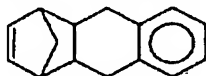
シクロペンタジエン-アセナフチレン付加物



1,4-メタノ-1,4,4a,9a-テトラヒドロフルオレン



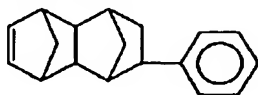
1,4-メタノ-1,4,4a,5,10,10a-ヘキサヒドロアントラセン



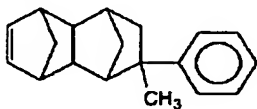
[0061]

[Formula 32]

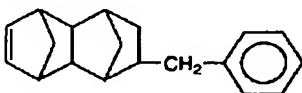
8-フェニル-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



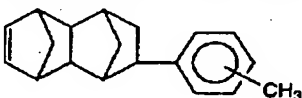
8-メチル-8-フェニル-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



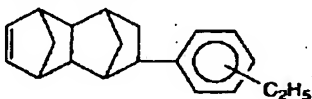
8-ベンジル-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



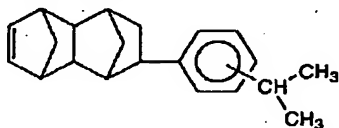
8-トリル-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



8-(エチルフェニル)-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン

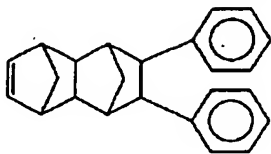
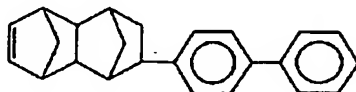
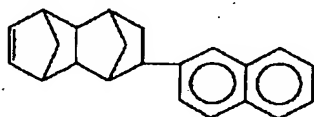
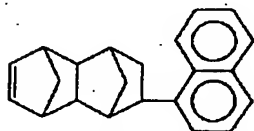
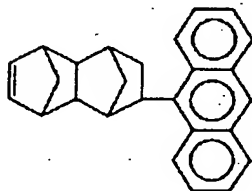


8-(イソプロピルフェニル)-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン



[0062]

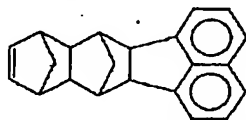
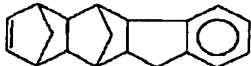
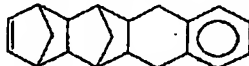
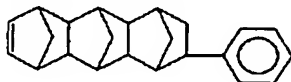
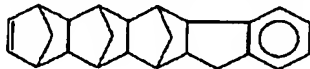
[Formula 33].

8, 9-ジフェニル-テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン8- (ビフェニル) -テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン8- (β-ナフチル) -テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン8- (α-ナフチル) -テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン8- (アントラセニル) -テトラシクロ [4. 4. 0. 1^{2,5}. 1^{7,10}] -3-ドデセン

[0063]

[Formula 34]

(シクロペンタジエン-アセナフチレン付加物) にシクロペンタジエンをさらに付加した化合物

11, 12-ベンゾ-ペンタシクロ [6. 5. 1. 1^{3,6}. 0^{2,7}. 0^{9,13}] -4-ペンタデセン11, 12-ベンゾ-ペンタシクロ [6. 6. 1. 1^{3,6}. 0^{2,7}. 0^{9,14}] -4-ヘキサデセン11-フェニル-ヘキサシクロ [6. 6. 1. 1^{3,6}. 1^{10,13}. 0^{2,7}. 0^{9,14}] -4-ヘプタデセン14, 15-ベンゾ-ヘプタシクロ [8. 7. 0. 1^{2,9}. 1^{4,7}. 1^{11,17}. 0^{3,8}. 0^{12,16}] -5-エイコセン

[0064] Cyclobutene, cyclopentene, a cyclohexene, 3-methyl cyclohexene, a cyclo heptene, cyclooctane, cyclodecene, cyclo dodecen, cyclo ray KOSEN, etc. 13, 6.110, 13.02, 7.09, and a 14]-4-heptadecene derivative are desirable. the inside of this -- a bicyclo [2.2.1]-2-heptene derivative and tetracyclo [-- 4. -- 4.0.12, 5.17, 10]-3-dodecen derivative, and hexa cyclo [-- 6. -- 6.1. -- Especially, a bicyclo [2.2.1]-2-heptene and tetracyclo [4. 4.0.12, 5.17, and 10]-3-dodecen are desirable.

[0065] The annular olefin expressed with above general formulas (I) or (II(s)) can be manufactured by carrying out the Diels-Alder reaction of a cyclopentadiene and the olefins which have the structure of corresponding. Two or more sorts of configuration units originating in these general formulas (I), (II), or (III) the annular olefin expressed may be included.

[0066] (Molecular weight distribution of an alpha olefin and an annular olefine copolymer) the molecular weight distribution (Mw/Mn) searched for with the gel permeation chromatography (GPC) of the alpha olefin and annular olefine copolymer concerning this invention -- usually -- $1.0 < (Mw/Mn) \leq 1.8$ -- desirable -- $1.0 < (Mw/Mn) \leq 1.7$ -- it is in the range of $1.0 < (Mw/Mn) \leq 1.6$ more preferably.

[0067] When (Mw/Mn) of an alpha olefin and an annular olefine copolymer is in above-mentioned within the limits, manufacture is easy and there is an inclination to excel in the homogeneity of presentation distribution. In addition, molecular weight distribution show the ratio (Mw/Mn) of the weight average molecular weight (Mw) measured by GPC, and number average molecular weight (Mn). In this invention, it asked by performing GPC measurement on the following conditions about the molecular weight of an alpha olefin and an annular olefine copolymer, and molecular weight distribution.

[0068]

Equipment: GPC Alliance2000 (Waters)

column: -- TSKgel GMH6-HT x 2+TSKgel GMH6-HTLx2 (total 30cmx 4 and TOSOH (CORP.))

detector: -- differential refractometer measurement solvent: -- o-dichlorobenzene measurement flow

rate: -- 1 mL/min measurement temperature: -- 140-degree-C sample injection rate: -- 500microL

standard-substance: -- mono dispersion polystyrene x16 (TOSOH CORP.)

(Molecular weight of an alpha olefin and an annular olefine copolymer)

the weight average molecular weight (Mw) calculated by GPC of the alpha olefin and annular olefine copolymer concerning this invention -- $1,000 \leq Mw \leq 5,000,000$ -- desirable -- $3,000 \leq Mw \leq 3,000,000$ -- more -- desirable -- $5,000 \leq Mw \leq 2,000,000$ -- it is in the range of $5,000 \leq Mw \leq 1,000,000$ still more preferably.

[0069] When the weight average molecular weight (Mw) of an alpha olefin and an annular olefine copolymer is in above-mentioned within the limits, there is an inclination to excel in reinforcement when it considers as a Plastic solid, and to excel in fabricating-operation nature. Mw in this description is a value at the time of measuring on the above-mentioned GPC conditions.

[0070] (Configuration unit of an alpha olefin and an annular olefine copolymer) the mole ratio (an alpha olefin / annular olefin) of the configuration unit (A) originating in the alpha olefin in the alpha olefin and annular olefine copolymer concerning this invention, and the configuration unit originating in an annular olefin -- 20 / 80 - 99/1 -- desirable -- the range of 30 / 70 - 90/10 -- more -- desirable -- the range of 40 / 60 - 80/20 -- it is the range of 50 / 50 - 70/30 still more preferably.

[0071] If the mole ratio of the configuration unit of the alpha olefin origin in an alpha olefin and an annular olefine copolymer and the configuration unit of the annular olefin origin is in above-mentioned within the limits, there is an inclination to excel in the optical property and mechanical characteristic which are the description of an alpha olefin and an annular olefine copolymer, a heat characteristic, etc., and manufacture is not difficult. In addition, the annular olefin content in a polymer asks for the annular olefin content by ¹³C-NMR analysis of a polymer, and the correlation type of Tg by DSC measurement beforehand, and is DSC measurement of a generation polymer. - The annular olefin content was computed using this correlation type from Tg.

[0072] The alpha olefin and annular olefine copolymer concerning manufacture approach this invention of an alpha olefin and an annular olefine copolymer The above-mentioned carbon atomic number The alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, The annular olefin expressed with the annular olefin expressed with the above-mentioned account general formula (I), and a general formula (II), At least one sort of annular olefins chosen from the group

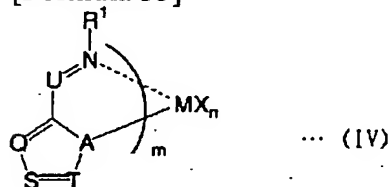
which consists of an annular olefin expressed with a general formula (III) And for example, the transition-metals compound expressed with the (C) following general formula (IV), (D) (D-1) An organometallic compound, an organic (D-2) aluminum oxy compound, And (D-3) it can manufacture by copolymerizing under existence of the catalyst for olefin polymerization which consists of at least one sort of compounds chosen from the compound which reacts with a transition-metals compound (C) and forms an ion pair.

[0073] Each component which forms hereafter the catalyst for olefin polymerization used by this invention is explained.

((C) transition-metals compound) The transition-metals compound (C) used in this invention is expressed with the following general formula (IV).

[0074]

[Formula 35]



[0075] Among a formula, M shows the transition-metals atom (a lanthanoids is also contained in three groups) chosen from the 3-11th groups of a periodic table, is three to 9 group's (a lanthanoids is also contained in three groups) metal atom preferably, is a transition-metals atom more preferably chosen from three to 5 group, and nine groups, and is a transition-metals atom especially chosen from four groups or five groups preferably. Specifically it is a scandium, titanium, a zirconium, a hafnium, vanadium, niobium, a tantalum, cobalt, a rhodium, an yttrium, chromium, molybdenum, a tungsten, manganese, a rhenium, iron, a ruthenium, etc., is a scandium, titanium, a zirconium, a hafnium, vanadium, niobium, a tantalum, cobalt a rhodium, etc. preferably and is titanium, a zirconium, a hafnium, cobalt, a rhodium, vanadium, niobium, a tantalum etc. more preferably, and they are titanium, a zirconium and hafnium especially preferably.

[0076] In addition, N Although having configured is shown, M does not have to be made general even if it has configured in this invention. A shows a nitrogen atom or the Lynn atom, and is a nitrogen atom preferably. In addition, in this invention, although association with A and Metal M is generally shown, A-M is included, also when the pyrrole radical is considering eta association as Metal M (when A is nitrogen).

[0077] U is the carbon atom or the Lynn atom which shows the carbon atom (- (R2) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R2, and has a substituent R2 preferably, and is a carbon atom which has a substituent R2 still more preferably. Q is a carbon atom which shows the carbon atom (- (R3) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R3, and has a substituent R3 preferably.

[0078] S is a carbon atom which shows the carbon atom (- (R4) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R4, and has a substituent R4 preferably. T is a carbon atom which shows the carbon atom (- (R5) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R5, and has a substituent R5 preferably. m -- the integer of 2-6 -- desirable -- the integer of 2-4 -- 2 is shown still more preferably.

[0079] Even if R1-R5 are mutually the same, they may differ from each other, and they show a hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical at the time of the transition-metals atom with which M is chosen from the 3-5th groups of a periodic table, and the 7-11th groups.

[0080] At the time of the transition-metals atom with which M is chosen from the 6th group of a periodic table R1 A hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an alicycle group hydrocarbon group, Heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. R2-R5 A hydrogen

atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown.

[0081] A fluorine, chlorine, a bromine, and iodine are mentioned as a halogen atom. As a hydrocarbon group showing R1, specifically Methyl, ethyl, n-propyl, Isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, carbon atomic numbers, such as neopentyl one and n-hexyl, -- 1-30 -- desirable -- the alkyl group; vinyl of the shape of a straight chain of 1-20, and the letter of branching -- carbon atomic numbers, such as an allyl compound and isopropenyl, -- 2-30 -- desirable -- the alkenyl radical; ethynyl of the shape of a straight chain of 2-20, and the letter of branching -- a carbon atomic number, such as propargyl, -- 2-30 -- desirable -- aliphatic hydrocarbon radicals, such as an alkynyl group of the shape of a straight chain of 2-20, and the letter of branching, -- Cyclo propyl, cyclo butyl, cyclopentyl, cyclohexyl, Cycloheptyl one, cyclo octyl, cyclo nonyl, cyclodecyl, 2-methyl-cyclohexyl, carbon atomic numbers, such as 2-tert-butyl-cyclohexyl, norbornyl, and adamantyl, -- 3-30 -- desirable -- the cycloalkane radical; cyclopentadienyl of 3-20 -- Alicycle group hydrocarbon groups, such as an annular unsaturated hydrocarbon radical of the carbon atomic numbers 5-30, such as indenyl and fluorenyl, Phenyl, benzyl, naphthyl, biphenyl, terphenyl, phenan tolyl, carbon atomic numbers, such as anthryl, -- 6-30 -- aromatic hydrocarbon radicals, such as alkylation aryl groups, such as aryl group; tolyl of 6-20, iso-propyl phenyl, t-buthylphenyl, dimethylphenyl, and G t-buthylphenyl, are mentioned preferably.

[0082] a hydrogen atom permutes the above-mentioned hydrocarbon group with a halogen -- having -- **** -- as such a hydrocarbon group -- the carbon atomic numbers 1-30, such as trifluoromethyl, pentafluorophenyl, and chlorophenyl, -- the halogenated hydrocarbon radical of 1-20 is mentioned preferably. Moreover, the above-mentioned hydrocarbon group may be permuted by other hydrocarbon groups, and aryl group permutation. alkyl groups, such as benzyl and cumyl, etc. are mentioned as such a hydrocarbon group, for example.

[0083] The above-mentioned hydrocarbon group further again A heterocyclic compound residue; alkoxy group, An aryloxy radical, an ester group, a ether group, an acyl group, a carboxyl group, Oxygen content radicals, such as a cull BONATO radical, a hydroxy group, a peroxy group, and a carboxylic anhydride radical; The amino group, An imino group, an amide group, an imide radical, a hydrazino radical, a hydrazono group, a nitro group, A nitroso group, a cyano group, an iso cyano group, a cyanic-acid ester group, an amidino group, Nitrogen content radicals, such as that from which a diazo group and the amino group became ammonium salt; A borane diyl radical, Boron content radicals, such as a borane TORIRU radical and a JIBORANIRU radical; A sulfhydryl group, A thioester radical, a dithio ester group, an alkylthio group, an aryl thio radical, A thioacyl radical, a thioether radical, a thiocyanate radical, an iso CHIAN acid ester group, A sulphone ester radical, a sulfonamide radical, a thio carboxyl group, a dithio carboxyl group, A sulfonic group, a sulfonyl group, a sulfinyl group, a sulfenyl radical, a sulfonate radical, Sulfur content radicals, such as a sulfinate group; you may permute by the Lynn content radicals, such as a phosphide radical, a phosphoryl group, a thio phosphoryl group, and a phosphato radical, the silicon content radical, the germanium content radical, or the tin content radical.

[0084] Thus, although the hydrocarbon group may be permuted by an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, the silicon content radical, the germanium content radical, the tin content radical, etc., it is desirable for the atomic group by which that radical is characterized not to couple substituents, such as an oxygen content radical, directly with N of a formula (I) in this case. among these -- especially -- the carbon atomic numbers 1-30 -- desirable -- the alkyl group; carbon atomic number of the shape of a straight chain of 1-20, and the letter of branching -- 3-30 -- desirable -- the cycloalkane radical; carbon atomic numbers 6-30 of 3-20 -- desirable -- aryl group [of 6-20]; -- these aryl groups -- a halogen atom -- the carbon atomic numbers 1-30 -- desirable -- the alkyl group of 1-20, and the carbon atomic numbers 1-30 -- desirable -- the alkoxy group of 1-20 -- the carbon atomic numbers 6-30 -- the aryl group of 6-20, the carbon atomic numbers 6-30, the permutation aryl group that 1-5 substituents, such as an aryloxy radical of 6-20, permuted preferably are preferably desirable.

[0085] Moreover, 3-30, and especially since an alpha olefin and not only annular olefin copolymerization activity but alpha olefin independent polymerization activity increases, the

cycloalkane radical of 3-20 has preferably desirable carbon atomic numbers, such as cyclo propyl, cyclo butyl, cyclopentyl, cyclohexyl, cycloheptyl one, cyclo octyl, cyclo nonyl, cyclodecyl, 2-methyl-cyclohexyl, 2-tert-butyl-cyclohexyl, norbornyl, and adamantyl.

[0086] Specifically, the same thing as what was illustrated as a hydrocarbon group which shows the above R1 is mentioned as a hydrocarbon group showing R2-R5. Although such a hydrocarbon group may be permuted by an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, the silicon content radical, the germanium content radical, the tin content radical, etc., it is desirable for the atomic group by which that radical is characterized not to couple substituents, such as an oxygen content radical, directly with U, Q, S and T of a formula (I), and the carbon atom in A in this case.

[0087] among these -- especially -- the carbon atomic numbers 1-30 -- desirable -- the alkyl group; carbon atomic number of the shape of a straight chain of 1-20, and the letter of branching -- 3-30 -- desirable -- the cycloalkane radical; carbon atomic numbers 6-30 of 3-20 -- desirable -- aryl group [of 6-20]; -- these aryl groups -- a halogen atom -- the carbon atomic numbers 1-30 -- desirable -- the alkyl group of 1-20, and the carbon atomic numbers 1-30 -- desirable -- the alkoxy group of 1-20 -- the carbon atomic numbers 6-30 -- the aryl group of 6-20, the carbon atomic numbers 6-30, the permutation aryl group that 1-5 substituents, such as an aryloxy radical of 6-20, permuted preferably are preferably desirable.

[0088] R1-R5 can be connected mutually [two or more pieces] of these, and they can also form a ring. As such a ring, the radical by which the hydrogen atom on condensed ring radicals, such as the benzene ring, a naphthalene ring, an acenaphthene ring, and an indene ring, and said condensed ring radical was permuted by alkyl groups, such as methyl, ethyl, propyl, and butyl, for example is mentioned. Heterocyclic compound residue is an annular radical which contains 1-5 hetero atoms in a radical, and O, N, S, P, and B are mentioned as a hetero atom. as a ring -- for example, the monocycle of four to 7 membered-ring and many rings -- the monocycle and many rings of five to 6 membered-ring are mentioned preferably. concrete -- for example, such residue, such as residue of ** sulfur compounds, such as residue of oxygenated compounds, such as residue of nitrogen-containing compounds, such as a pyrrole, a pyridine, a pyrimidine, a quinoline, and triazine, a furan, and a pyran, and a thiophene, -- a carbon atomic number -- 1-30 -- the alkyl group of 1-20 and a carbon atomic number are preferably mentioned for 1-30, the radical that substituents, such as an alkoxy group of 1-20, permuted further preferably.

[0089] An oxygen content radical is a radical which contains 1-5 oxygen atoms in a radical, and the above-mentioned heterocycle compound residue is not contained. Moreover, the radical which these atoms and oxygen atoms couple directly is not contained in an oxygen content radical, either, including a nitrogen atom, a sulfur atom, the Lynn atom, a halogen atom, or a silicon atom. An alkoxy group, an aryloxy radical, an ester group, a ether group, an acyl group, a carboxyl group, a cull BONATO radical, a hydroxy group, a peroxy group, a carboxylic anhydride radical, etc. are mentioned, and an alkoxy group, an aryloxy radical, an acetoxyl radical, a carbonyl group, a hydroxy group, etc. are specifically as an oxygen content radical desirable. In addition, when an oxygen content radical contains a carbon atom, it is desirable 1-30, and for a carbon atomic number to be in the range of 1-20 preferably.

[0090] A nitrogen content radical is a radical which contains 1-5 nitrogen atoms in a radical, and the above-mentioned heterocycle compound residue is not contained. That from which the amino group, an imino group, an amide group, an imide radical, a hydrazino radical, a hydrazono group, a nitro group, a nitroso group, a cyano group, an iso cyano group, a cyanic-acid ester group, an amidino group, a diazo group, and the amino group became ammonium salt is specifically as a nitrogen content radical mentioned, and the amino group, an imino group, an amide group, an imide radical, a nitro group, and a cyano group are desirable. In addition, when a nitrogen content radical contains a carbon atom, it is desirable 1-30, and for a carbon atomic number to be in the range of 1-20 preferably.

[0091] A boron content radical is a radical which contains 1-5 boron atoms in a radical, and the above-mentioned heterocycle compound residue is not contained. Boron content radicals, such as a borane diyl radical, a borane TORJIRU radical, and a JIBORANIRU radical, are mentioned, and 1-30, the BORIRU radical that 1-2 hydrocarbon groups of 1-20 permuted preferably, or the borate

radical permuted 1-3 pieces specifically as a boron content radical has a desirable carbon atomic number. When two or more hydrocarbon groups have permuted, even if each hydrocarbon is the same, it may differ.

[0092] A sulfur content radical is a radical which contains 1-5 sulfur atoms in a radical, and the above-mentioned heterocycle compound residue is not contained. A sulfhydryl group, a thioester radical, a dithio ester group, an alkylthio group, an aryl thio radical, a thioacyl radical, a thioether radical, a thiocyanate radical, an iso CHIAN acid ester group, a sulphone ester radical, a sulfonamide radical, a thio carboxyl group, a dithio carboxyl group, a sulfonic group, a sulfonyl group, a sulfinyl group, a sulfenyl radical, a sulfonate radical, a sulfinatate group, etc. are mentioned, and a sulfonate radical, a sulfinatate group, an alkylthio group, and an aryl thio radical are specifically as a sulfur content radical desirable. In addition, when a sulfur content radical contains a carbon atom, it is desirable 1-30, and for a carbon atomic number to be in the range of 1-20 preferably.

[0093] The Lynn content radical is a radical which contains the Lynn atom of 1-5 in a radical, and the above-mentioned heterocycle compound residue is not contained. A phosphino radical, a phosphoryl group, a phospho CHIOIRU radical, a phosphono radical, etc. are specifically as a Lynn content radical mentioned. A silicon content radical is a radical which contains the silicon atom of 1-5 in a radical, for example, siloxy radicals, such as silyl radicals, such as a hydrocarbon permutation silyl radical, and a hydrocarbon permutation siloxy radical, are mentioned. Specifically, methyl silyl, dimethylsilyl, trimethylsilyl, ethyl silyl, diethyl silyl, triethyl silyl, diphenyl methyl silyl, triphenyl silyl, dimethylphenyl silyl, dimethyl-t-butylsilyl, dimethyl (pentafluorophenyl) silyl, etc. are mentioned. In these, methyl silyl, dimethylsilyl, trimethylsilyl, ethyl silyl, diethyl silyl, triethyl silyl, dimethylphenyl silyl, triphenyl silyl, etc. are desirable. Trimethylsilyl, triethyl silyl, triphenyl silyl, and dimethylphenyl silyl are especially desirable. Specifically, trimethylsiloxy etc. is mentioned as a hydrocarbon permutation siloxy radical. In addition, when a silicon content radical contains a carbon atom, it is desirable 1-30, and for a carbon atomic number to be in the range of 1-20 preferably.

[0094] As a germanium content radical and a tin content radical, what permuted the silicon of said silicon content radical by germanium and tin is mentioned. In addition, as for the above, an oxygen content radical, a nitrogen content radical, a sulfur content radical, a boron content radical, and the Lynn content radical, it is desirable that the atomic group by which the radical is characterized is the radical which is coupled directly with N of a formula (IV) and the carbon atom in U, Q, S, T, and A.

[0095] Next, the example of R1-R5 which were explained above is explained more concretely. As an alkoxy group, among oxygen content radicals, methoxy and ethoxy **n-propoxy, Isopropoxy, n-butoxy, iso butoxy, tert-butoxy, etc. as an aryloxy radical Phenoxy, 2, 6-dimethyl phenoxy, 2 and 4, 6-trimethyl phenoxy, etc. as an acyl group The formyl, acetyl, benzoyl, p-chloro benzoyl, p-methoxy BENSOIRU, etc. are preferably illustrated for acetyloxy, benzoyloxy one, methoxycarbonyl, phenoxy carbonyl, p-chloro phenoxy carbonyl, etc. as an ester group.

[0096] As an amide group, an acetamide, N-methyl acetamide, N-methyl benzamide, etc. among nitrogen content radicals as an amino group Methylamino, dimethylamino, diethylamino, dipropylamino, Alkylamino radicals, such as dibutylamino and dicyclohexylamino; Phenylamino, An arylamino radical or alkyl arylamino radicals, such as diphenylamino, ditolylamino, dinaphthylamino, and methylphenylamino, etc. as an imide radical Aceto imide, bends imide, etc. are preferably illustrated for methylimino, ethylimino, propyl imino ** butyl imino ** phenylimino, etc. as an imino group.

[0097] As an alkylthio group, among sulfur content radicals A methylthio, ethyl thio, etc. as an aryl thio radical Phenylthio, methyl phenylthio, NARUCHIRUCHIO, etc. as a thioester radical Acetyl thio, benzoyl thio, methylthio carbonyl, phenylthio carbonyl, etc. as a sulphone ester radical Sulfonic-acid methyl, sulfonic-acid ethyl, sulfonic-acid phenyl, etc. are preferably mentioned for a phenyl sulfonamide, N-methyl sulfonamide, N-methyl-p-toluenesulfonamide, etc. as a sulfonamide radical.

[0098] As a sulfonate radical, methyl sulfonate, trifluoromethane sulfonate, Phenyl sulfonate, benzyl sulfonate, p-toluene sulfonate, Trimethyl benzene sulfonate, TORIISO butylbenzene sulfonate, p-chlorobenzene sulfonate, pentafluoro benzene sulfonate, etc. As a sulfinatate group, methyl sulfinatate, phenyl sulfinatate, benzyl SURUFINETO, p-toluenesulfonate, trimethyl benzene sulfinatate, pentafluoro benzene sulfinatate, etc. are mentioned.

[0099] As a phosphino radical, as a phosphoryl group, dimethylphosphino, diphenylphosphino, etc. are mentioned, the methyl phosphoryl, the isopropyl phosphoryl, the phenyl phosphoryl, etc. are mentioned, methyl phospho CHIOIRU, isopropyl phospho CHIOIRU, phenyl phospho CHIOIRU, etc. are mentioned, and phosphoric ester radicals, such as phosphoric-acid dimethyl, phosphoric-acid diisopropyl, and phosphoric-acid diphenyl, a phosphoric-acid radical, etc. are mentioned as a phosphono radical as a phospho CHIOIRU radical among the Lynn content radicals.

[0100] in addition, at the time of the transition-metals atom with which M is chosen from the 3-5th groups of a periodic table, and the 7-11th groups, R1-R5 A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, At the time of the transition-metals atom with which it is a nitrogen content radical, a boron content radical, a sulfur content radical, a silicon content radical, a germanium content radical, or a tin content radical, and M is chosen from the 6th group of a periodic table R1 A hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an alicycle group hydrocarbon group, Heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, It is a silicon content radical, a germanium content radical, or a tin content radical, and R2-R5 are a hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, a silicon content radical, a germanium content radical, or a tin content radical.

[0101] furthermore, at the time of the transition-metals atom with which M is chosen from the 3-5th groups of a periodic table, and the 7-11th groups, R1-R5 A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, At the time of the transition-metals atom with which it is desirable that they are especially a nitrogen content radical, a sulfur content radical, and a silicon content radical with an atom, and M is chosen from the 6th group of a periodic table R1 A hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an alicycle group hydrocarbon group, It is desirable that it is heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a sulfur content radical, and a silicon content radical, and R2-R5 are especially a hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a sulfur content radical, and a silicon content radical.

[0102] As for especially R5, it is desirable that they are a hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, a hydrocarbon permutation silyl radical, a hydrocarbon permutation siloxy radical, an alkoxy group, an alkylthio group, an aryloxy radical, an aryl thio radical, an acyl group, an ester group, a thioester radical, an amide group, the amino group, an imide radical, an imino group, a sulphone ester radical, a sulfonamide radical, a cyano group, a nitro group, or a hydroxy group, and it is desirable that they are a hydrogen atom, a halogen atom, a hydrocarbon group, and a hydrocarbon permutation silyl radical further in respect of activity.

[0103] As a hydrocarbon group desirable as R5, methyl, ethyl, n-propyl, Isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, carbon atomic numbers, such as neopentyl one and n-hexyl, -- 1-30 -- desirable -- the alkyl group; cyclo propyl of the shape of a straight chain of 1-20, and the letter of branching -- carbon atomic numbers, such as cyclo butyl, cyclopentyl, cyclohexyl, and adamantyl, -- 3-30 -- desirable -- the cycloalkane radical; phenyl of 3-20 -- carbon atomic numbers, such as benzyl, naphthyl, biphenyl, and TORIFENIRU, -- 6-30 -- desirable -- aryl group [of 6-20]; -- and these radicals -- a carbon atomic number -- 1-30 -- desirable -- the alkyl group of 1-20, or an alkoxy group -- a carbon atomic number -- 1-30 -- the alkyl halide radical of 1-20 and a carbon atomic number are preferably mentioned for 6-30, the radical that substituents, such as the aryl group of 6-20 or an aryloxy radical, a halogen, a cyano group, a nitro group, and a hydroxy group, permuted further preferably.

[0104] As a hydrocarbon permutation silyl radical desirable as R5, methyl silyl, dimethylsilyl, trimethylsilyl, ethyl silyl, diethyl silyl, triethyl silyl, diphenyl methyl silyl, triphenyl silyl, dimethylphenyl silyl, dimethyl-t-butylsilyl, dimethyl (pentafluorophenyl) silyl, etc. are mentioned. Trimethylsilyl, triethyl phenyl silyl, diphenyl methyl silyl, iso phenyl silyl, dimethylphenyl silyl, dimethyl-t-butylsilyl, dimethyl (pentafluorophenyl) silyl, etc. are mentioned especially preferably.

[0105] R1-R5 may form the hydrocarbon ring in which 2 or more of radicals of these and the radical which adjoins preferably connect with mutually, and contains different atoms, such as a fat ring, a

ring, or a nitrogen atom, and these rings may have the substituent further. Moreover, a joint radical or single bond may be formed by one of 1 of R1-R5 which are contained in any one ligand radicals, and R1-R5 which are contained in other ligands radicals, and even if R1 comrades, R2 comrades, R3 comrades, R4 comrades, and R5 comrades are mutually the same, they may differ.

[0106] the number with which n fills the valence of M -- it is -- concrete -- 0-5 -- desirable -- 1-4 -- it is the integer of 1-3 more preferably. X shows a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen content radical, a sulfur content radical, a nitrogen content radical, a boron content radical, an aluminum content radical, the Lynn content radical, a halogen content radical, heterocyclic compound residue, a silicon content radical, a germanium content radical, or a tin content radical. In addition, when n is two or more, even if mutually the same, you may differ.

[0107] A fluorine, chlorine, a bromine, and iodine are mentioned as a halogen atom. As a hydrocarbon group, what was illustrated by said R1-R5, and the same thing are mentioned. Specifically Methyl, ethyl, propyl, butyl, hexyl, octyl, Alkyl groups, such as nonyl, dodecyl, and eye KOSHIRU; Cyclopentyl, Carbon atomic numbers, such as cyclohexyl, norbornyl, and adamantyl, the cycloalkyl radical; vinyl of 3-30, Alkenyl radicals, such as propenyl and cyclohexenyl; Benzyl, phenylethyl, Arylated alkyl radicals, such as phenylpropyl; aryl groups, such as phenyl, tolyl, dimethylphenyl, trimethyl phenyl, ethyl phenyl, propyl phenyl, biphenyl, naphthyl, methyl naphthyl, anthryl, and phenan tolyl, etc. are mentioned. Moreover, halogenated hydrocarbon and the radical which at least one hydrogen of the hydrocarbon group of the carbon atomic numbers 1-20 permuted by the halogen are also specifically contained in these hydrocarbon groups.

[0108] The thing of 1-20 has [among these] a desirable carbon atomic number. As an oxygen content radical, what was illustrated by said R1-R5, the same thing, etc. are mentioned, and, specifically, aryl alkoxy group; acetoxo radical; carbonyl groups, such as aryloxy radical; phenyl methoxies, such as alkoxy group; phenoxies, such as hydroxy group; methoxy and ethoxy ** propoxy and butoxy one, methylphenoxy, dimethyl phenoxy, and naphthoxy one, and phenylethoxy, etc. are mentioned.

[0109] As a sulfur content radical, what was illustrated by said R1-R5, the same thing, etc. are mentioned. Specifically Methyl sulfonate, trifluoromethane sulfonate, phenyl sulfonate, Benzyl sulfonate, p-toluene sulfonate, trimethyl benzene sulfonate; TORISO butylbenzene sulfonate, p-chlorobenzene sulfonate, Sulfonate radicals, such as pentafluoro benzene sulfonate; Methyl sulfinato, Sulfinato group; alkylthio groups, such as phenyl sulfinato, benzyl SURUFINETO, p-toluenesulfonate, trimethyl benzene sulfinato. and pentafluoro benzene sulfinato; an aryl thio radical etc. is mentioned.

[0110] As a nitrogen content radical, what was illustrated by said R1-R5, the same thing, etc. are mentioned, and, specifically, an arylamino radical or alkyl arylamino radicals, such as alkylamino radical; phenylamino, such as amino-group; methylamino, dimethylamino, diethylamino, dipropylamino, dibutylamino, and dicyclohexylamino, diphenylamino, ditolylamino, dinaphthylamino, and methylphenylamino, etc. are mentioned.

[0111] Specifically, BR4 (R shows an aryl group, a halogen atom, etc. which may have hydrogen, an alkyl group, and a substituent.) etc. is mentioned as a boron content radical. Specifically, AlR4 (R shows an aryl group, a halogen atom, etc. which may have hydrogen, an alkyl group, and a substituent.) etc. is mentioned as an aluminum content radical. Specifically, phosphite radical (phosphide radical); phosphonic acid radical; phosphinic acid radicals, such as thoria reel phosphine radical; methyl phosphite, such as trialkylphosphine radical; triphenyl phosphine, such as a trimethyl phosphine, tributyl phosphine, and tri-cyclohexyl phosphine, and a tritolyl phosphine, ethylphosphite, and phenyl phosphite, etc. are mentioned as a Lynn content radical.

[0112] Specifically, iodine content radicals, such as chlorine content radicals, such as fluorine content radicals, such as PF6 and BF4, and ClO4, SbCl6, and IO4, etc. are mentioned as a halogen content radical. As heterocyclic compound residue, what was illustrated by said R1-R5, the same thing, etc. are mentioned. What was illustrated by said R1-R5, and the same thing are specifically mentioned as a silicon content radical. Specifically Phenyl silyl, diphenyl silyl, trimethylsilyl, triethyl silyl, TORIPURO pill silyl, tricyclohexyl silyl, triphenyl silyl, Methyl diphenyl silyl, tritolyl silyl, hydrocarbon permutation silyl radical [, such as trinaphthyl silyl,]; -- hydrocarbon permutation silyl ether group [, such as the trimethylsilyl ether,]; -- silicon permutation alkyl group [, such as

trimethylsilylmethyl,]; -- silicon permutation aryl groups, such as trimethylsilyl phenyl, etc. are mentioned.

[0113] As a germanium content radical, what was illustrated by said R1-R5, and the same thing are mentioned, and, specifically, the radical which permuted the silicon of said silicon content radical by germanium is mentioned. As a tin content radical, what was illustrated by said R1-R5, and the same thing are mentioned, and, specifically, the radical which permuted the silicon of said silicon content radical by tin is mentioned.

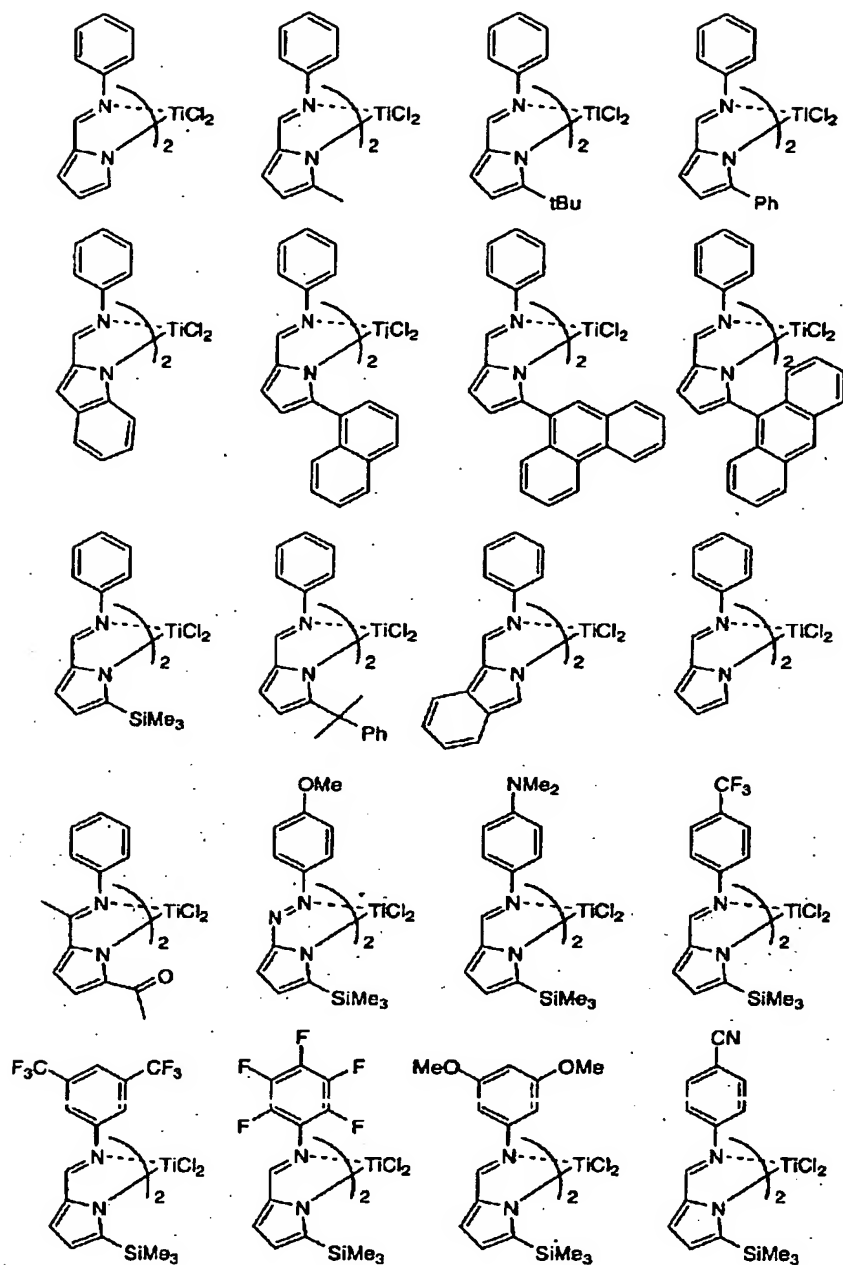
[0114] In addition, when n is two or more, it may join together mutually and two or more radicals which may differ even if two or more radicals shown by X are mutually the same, and are shown by X may form a ring. As X, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen content radical, and a nitrogen content radical are desirable, and a hydrogen atom, a halogen atom, and a hydrocarbon group are more desirable. Although the concrete example of a transition-metals compound expressed with the above-mentioned general formula (IV) below is shown, it is not limited to these.

[0115] In addition, in the following example, M is a transition-metals atom, for example, shows Sc (III), Ti (III), Ti (IV), Zr (III) and Zr (IV), Hf (IV), V (IV), Nb (V), Ta (V), Co (II), Co (III) and Rh (II), and Rh (III) and Rh (IV). Especially in these, Ti (IV), Zr (IV), and Hf (IV) are desirable.

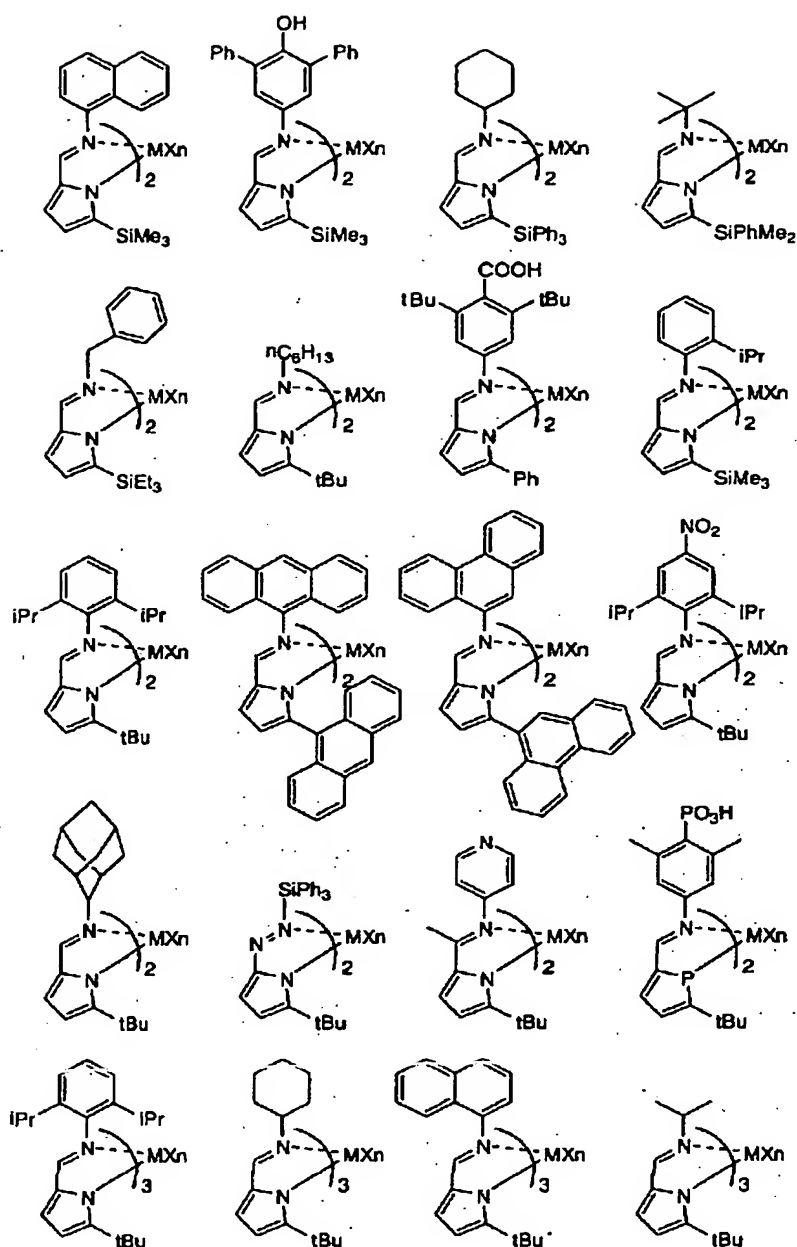
[0116] X shows alkyl groups, such as halogens, such as Cl and Br, or methyl. Moreover, when there is two or more X, even if these are the same, they may differ. n is determined by the valence of Metal M. For example, when two sorts of mono-anion kinds have combined with the metal, at divalent metal, it is set to $n=1$ in $n=0$ and trivalent metal, and is set $n=3$ with $n=2$ and a pentavalent metal by the quadrivalent metal. For example, when a metal is Ti (IV), it is $n=2$, and in the case of Zr (IV), it is $n=2$, and, in Hf (IV), is $n=2$.

[0117]

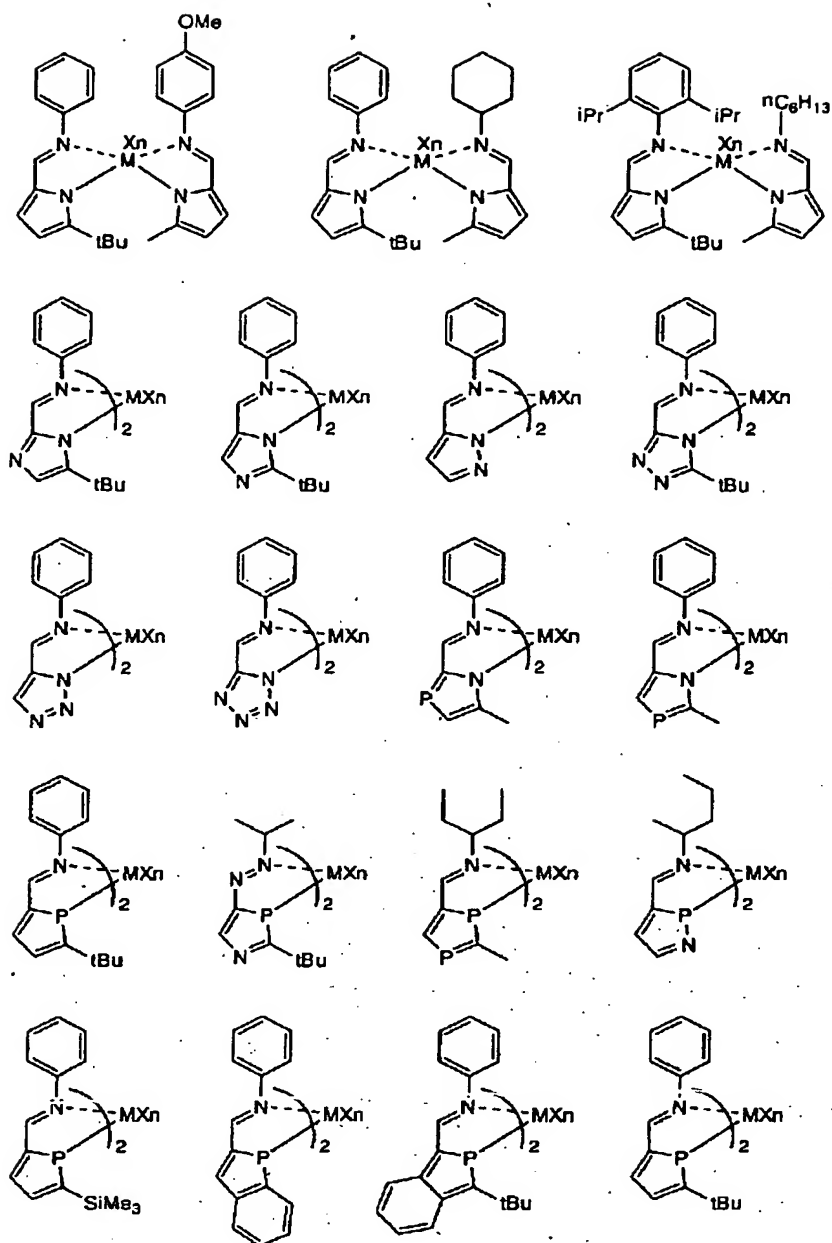
[Formula 36]



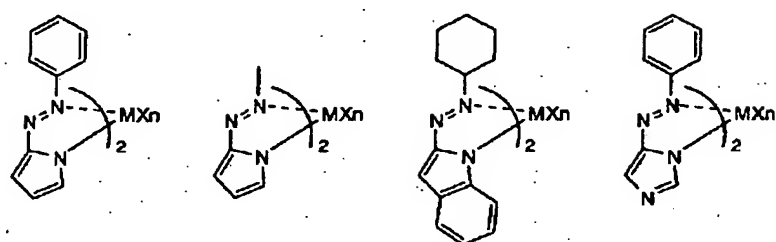
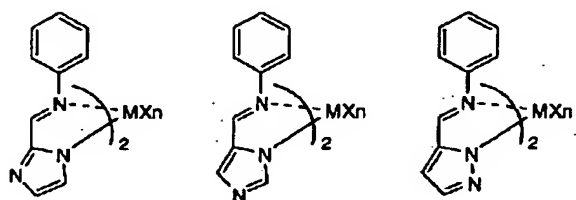
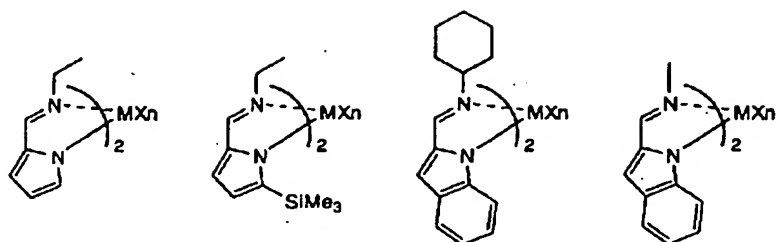
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[Formula 37]



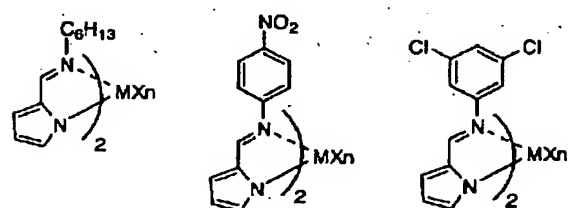
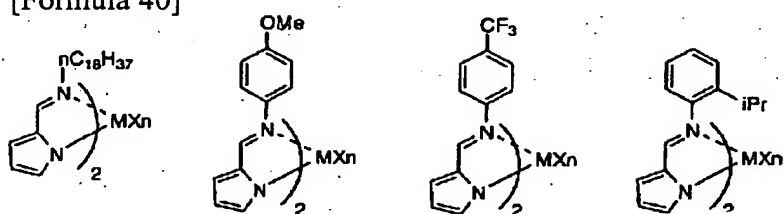
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[Formula 38]



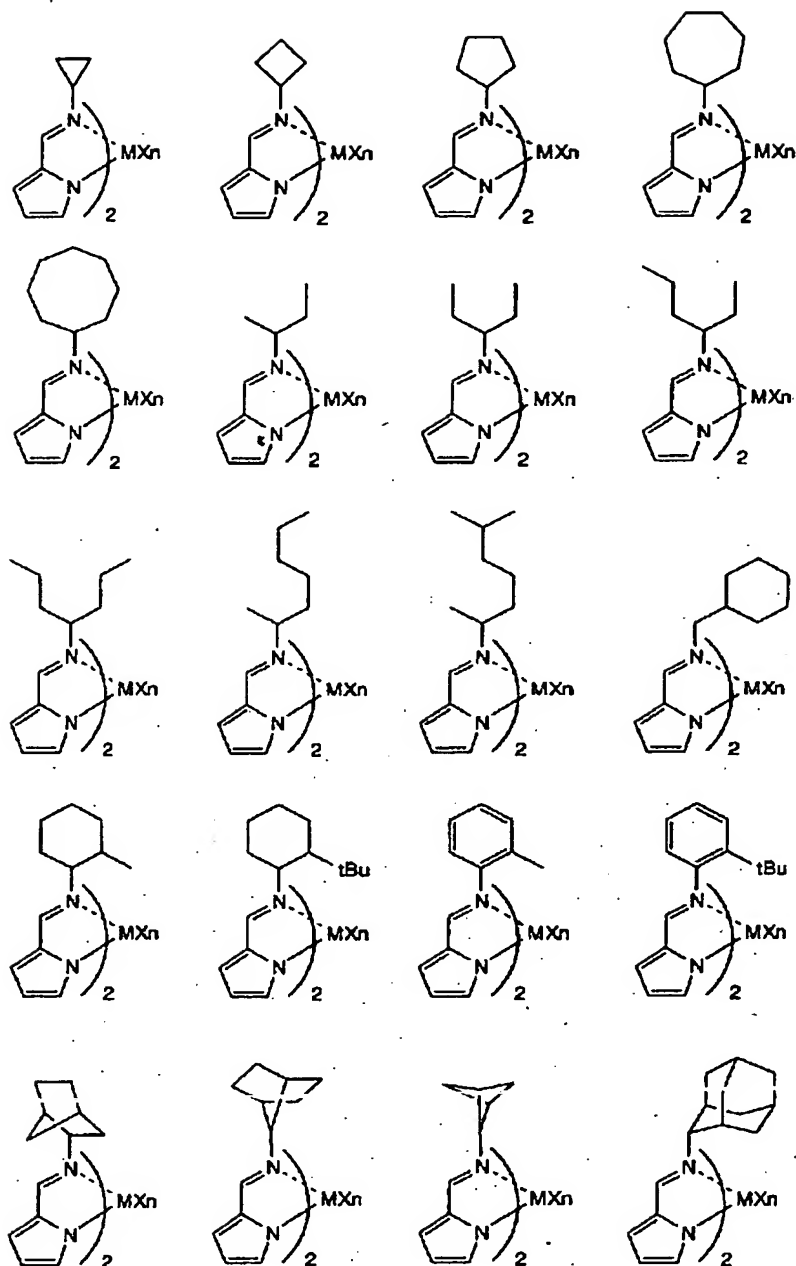
[0120]
[Formula 39]



[0121]
[Formula 40]



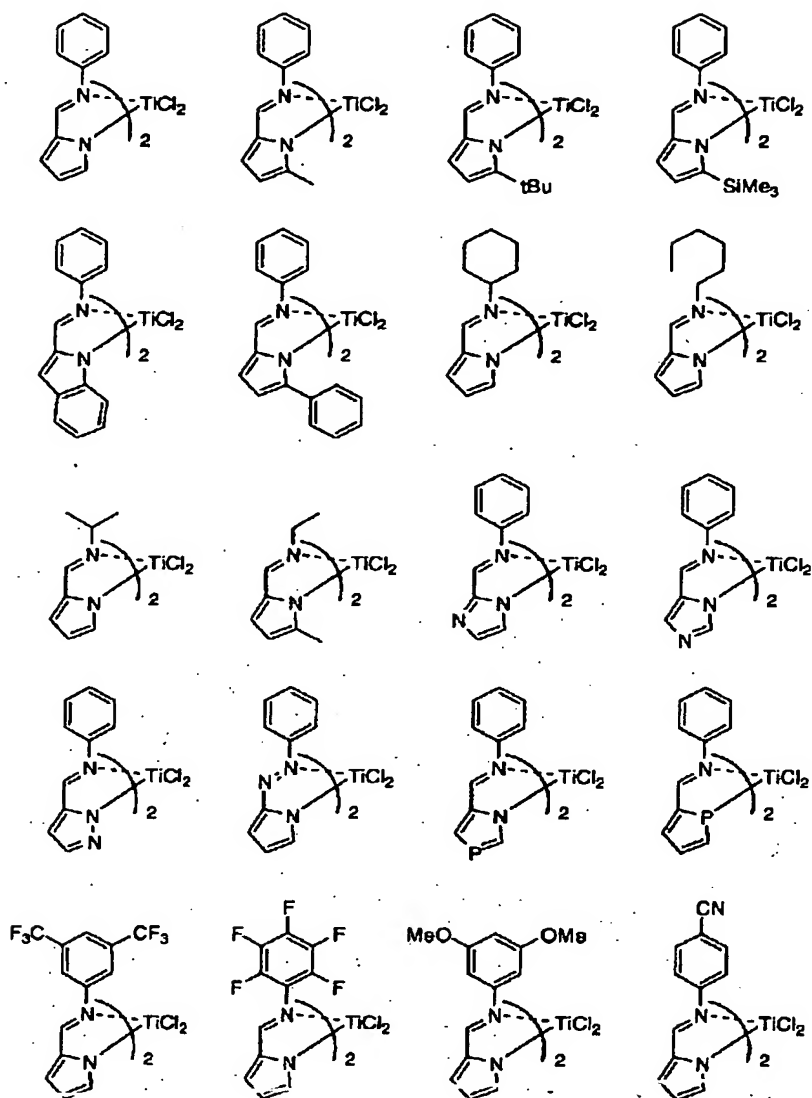
[0122]
[Formula 41]



[0123] What transposed titanium to the hafnium or the zirconium in the following titanium compounds and these compounds as a more concrete compound as a transition-metals compound expressed with such an above-mentioned general formula (IV) can be illustrated.

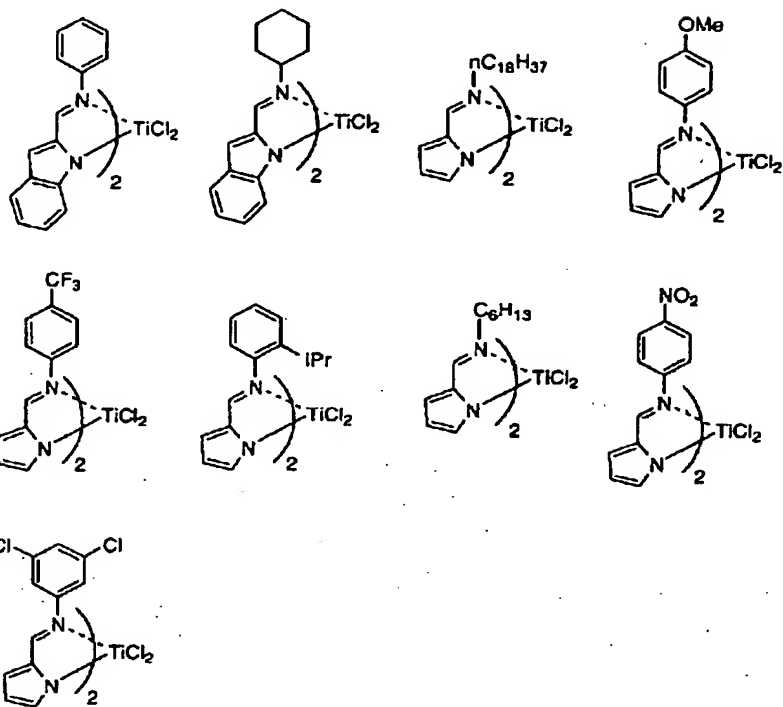
 $[0124]$

[Formula 42]

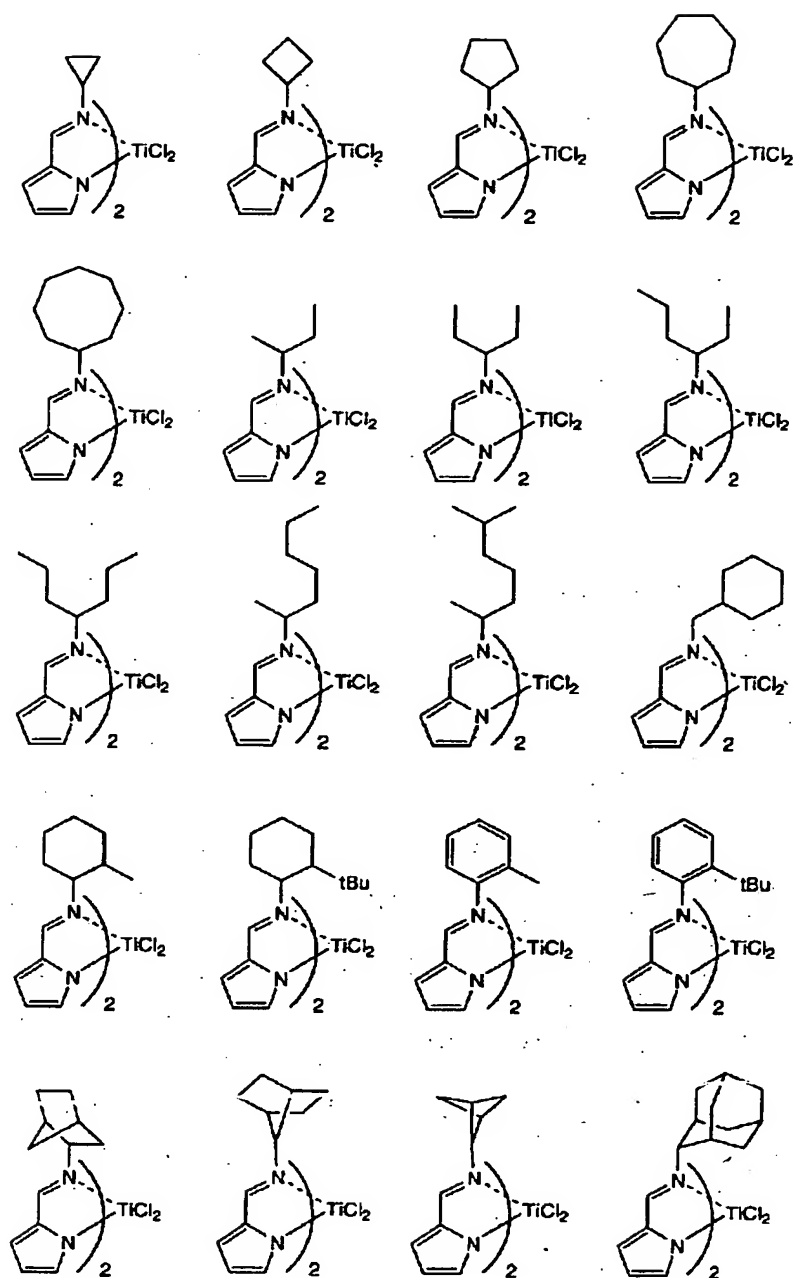


[0125]

[Formula 43]



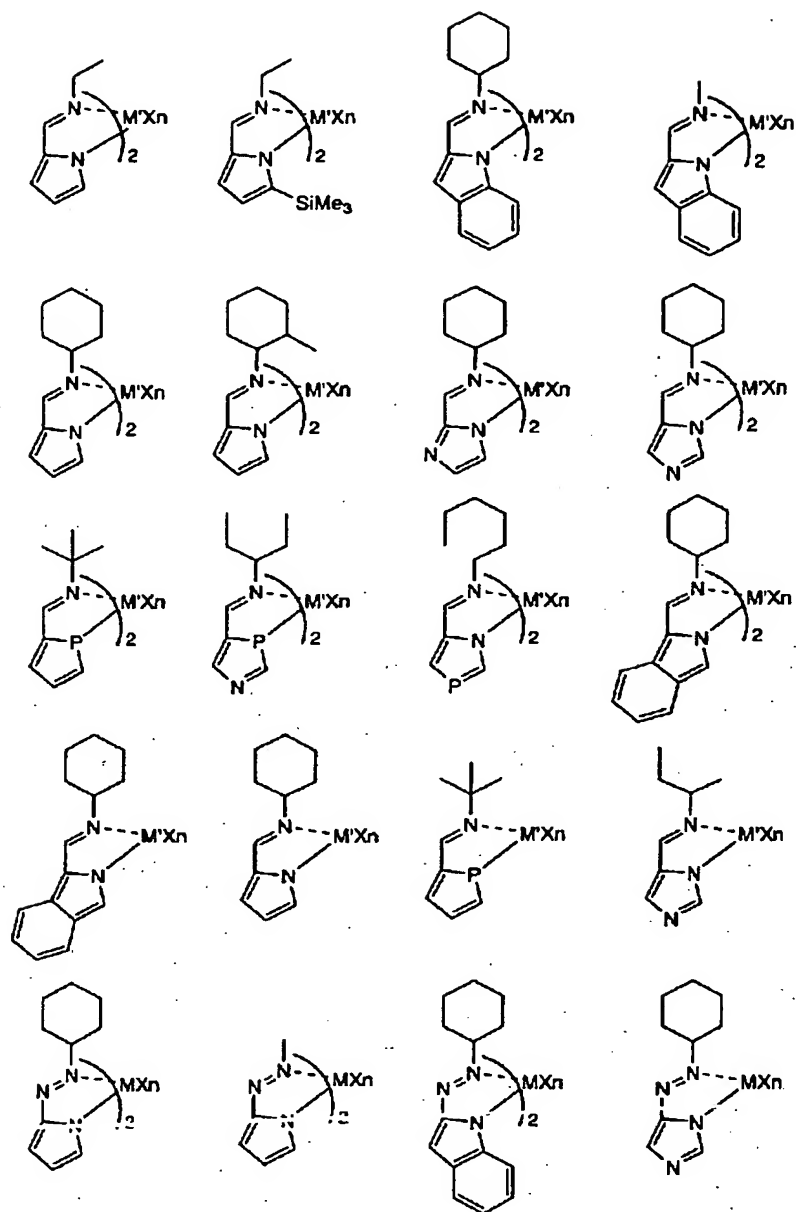
[0126]
[Formula 44]



[0127] Moreover, although it is expressed with the above-mentioned general formula (IV) and the example of a compound in which M is transition-metals atom M' of the 6th group of a periodic table is shown below, it is not limited to these.

[0128]

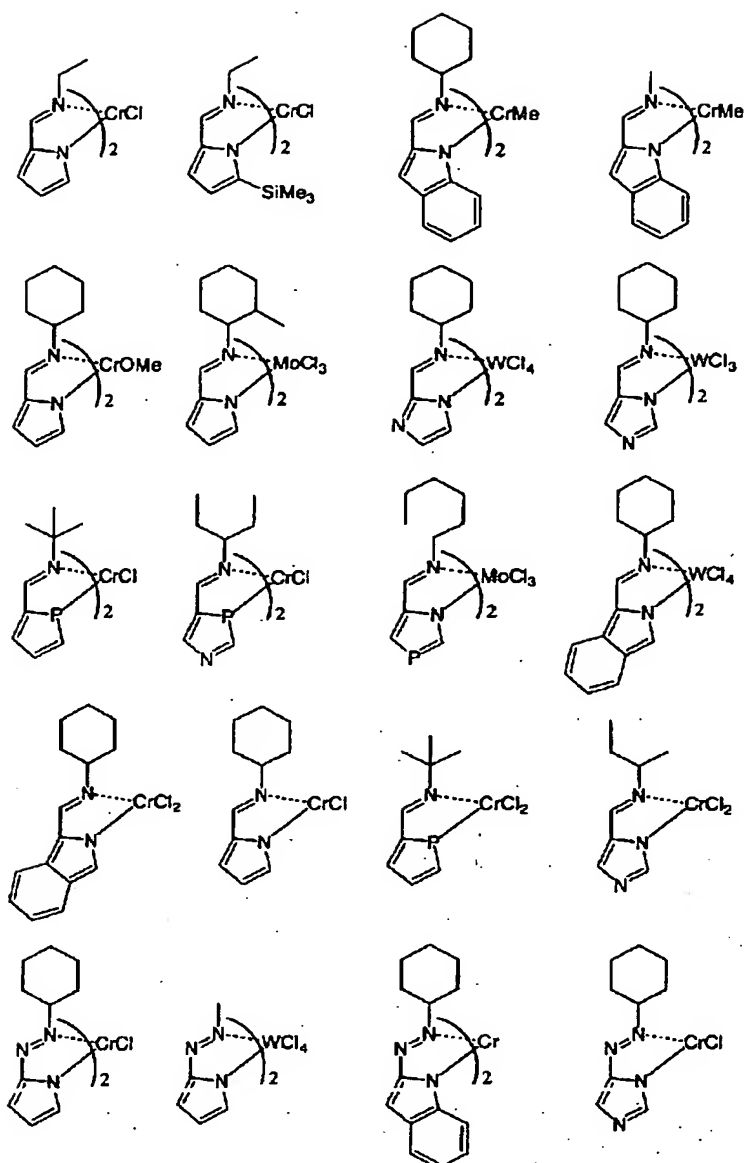
[Formula 45]



[0129] Although it is expressed with such an above-mentioned general formula (IV) and the example of a transition-metals compound in which M is the 6th group's transition-metals atom is shown below, it is not limited to these.

[0130]

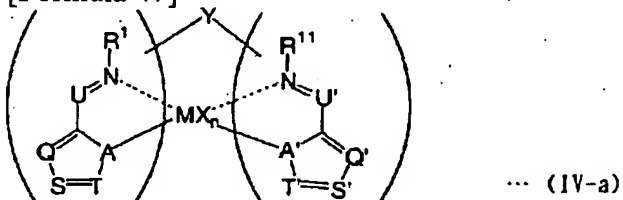
[Formula 46]



[0131] In addition, during the above-mentioned instantiation, in an ethyl group and iPr, i-propyl group and tBu show tert-butyl and, as for Me, Ph shows [a methyl group and Et] a phenyl group. In the transition-metals compound expressed with the above-mentioned general formula (IV), m is 2 and there is a compound expressed with the following general formula (IV-a), for example as a compound which forms a joint radical or single bond by one of 1 of R1-R5 which are contained in the ligand of 1 radicals, and R1-R5 which are contained in other ligands radicals.

[0132]

[Formula 47]



[0133] M, A, Q, S, T, U, R1-R5, and X are synonymous with M, A, Q, S, T, U, R1-R5, and X in the above-mentioned general formula (IV) respectively among a formula (IV-a), and A' is synonymous with A. U' is the carbon atom or the Lynn atom which shows the carbon atom (-R12) C=, nitrogen atom (-N=), or the Lynn atom (-P=) which has a substituent R12, and has a substituent R12

preferably, and is a carbon atom which has a substituent R12 still more preferably.

[0134] Q' is a carbon atom which shows the carbon atom (- (R13) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R13, and has a substituent R13 preferably. S' is a carbon atom which shows the carbon atom (- (R14) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R14, and has a substituent R14 preferably. T' is a carbon atom which shows the carbon atom (- (R15) C=), nitrogen atom (- N=), or the Lynn atom (- P=) which has a substituent R15, and has a substituent R15 preferably.

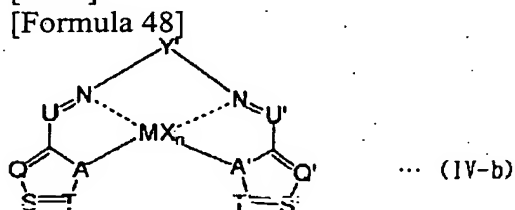
[0135] You may differ, even if R11-R15 are mutually the same, and R11 is synonymous with R1, and R12-R15 are synonymous with R2-R5. Moreover, you may differ, even if R1-R5, and R11-R15 are mutually the same, and 2 or more of R1-R5, and R11-R15 radicals and the radical which adjoins preferably may form the hydrocarbon ring which connects mutually and contains different atoms, such as an aliphatic series ring, an aromatic series ring, or a nitrogen atom.

[0136] Y is the joint radical or single bond formed by at least one radical chosen from R1-R5, and at least one radical chosen from R11-R15. As a joint radical shown by Y, oxygen, sulfur, carbon, nitrogen, Lynn, silicon, The radical containing at least one sort of atoms chosen from a selenium, tin, boron, etc. is mentioned. Specifically Chalcogen atom content radical; -NH(s)[, such as -O-, -S-, and -Se-,], - Nitrogen, such as N(CH3)2-, -PH-, and -P(CH3)2-, or Lynn atom content radical; -CH2-, Carbon atomic numbers, such as CH2-CH2- and -C(CH3)2-, - The hydrocarbon-group; benzene of 1-20, as for carbon atomic numbers, such as naphthalene and an anthracene, 6-20 are annular -- an unsaturated hydrocarbon residue; pyridine -- The carbon atomic number containing hetero atoms, such as a quinoline, a thiophene, and a furan, heterocyclic compound residue; -SiH2- of 3-20, - Boron atom content radicals, such as tin atom content radical; -BHs[, such as silicon atom content radicals such as Si(CH3)2-, -SnH2-, and -Sn(CH3)2-,], -B(CH3)-, and -BF-, etc. are mentioned.

[0137] Moreover, as a transition-metals compound which forms a joint radical or single bond by R1 and R11 among the compounds expressed with a general formula (IV-a), there is a transition-metals compound expressed with the following general formula (IV-b).

[0138]

[Formula 48]



[0139] M, A, Q, S, T, U, R2-R5, and X among a formula (IV-b) respectively -- the above -- a general formula -- (-- IV --) -- inside -- M -- A -- Q -- S -- T -- U -- R -- two - R -- five -- and -- X -- synonymous -- A -- ' -- Q -- ' -- S -- ' -- T -- ' -- U -- ' -- and -- R -- 12 - R -- 15 -- respectively -- a general formula (IV-a) -- inside -- A -- ' -- Q -- ' -- S -- ' -- T -- ' -- U -- ' -- and -- R -- 12 - R -- 15 -- being synonymous . You may differ, even if R2-R5, and R12-R15 are mutually the same, and 2 or more of R2-R5, and R12-R15 radicals and the radical which adjoins preferably may form the hydrocarbon ring which connects mutually and contains different atoms, such as an aliphatic series ring, an aromatic series ring, or a nitrogen atom.

[0140] a general formula (IV-b) -- setting -- R4 or R14 -- at least -- on the other hand -- especially, it is desirable that both are a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical. n is a number which fills the valence of M.

[0141] Especially as X, the hydrocarbon group or sulfonate radical of 1-20 has a halogen atom and a desirable carbon atomic number. When n is two or more, the ring which two or more X connects mutually and forms may be an aromatic series ring, or may be an aliphatic series ring. Although Y' is synonymous with Y in the above-mentioned general formula (IV-a), when it is a hydrocarbon group, it is a radical which consists of three or more carbon atoms. As for these joint radical Y', a principal chain has preferably the structure which consisted of four or more pieces [ten or less] preferably especially four or more pieces [20 or less] three or more atoms. In addition, these joint radicals may

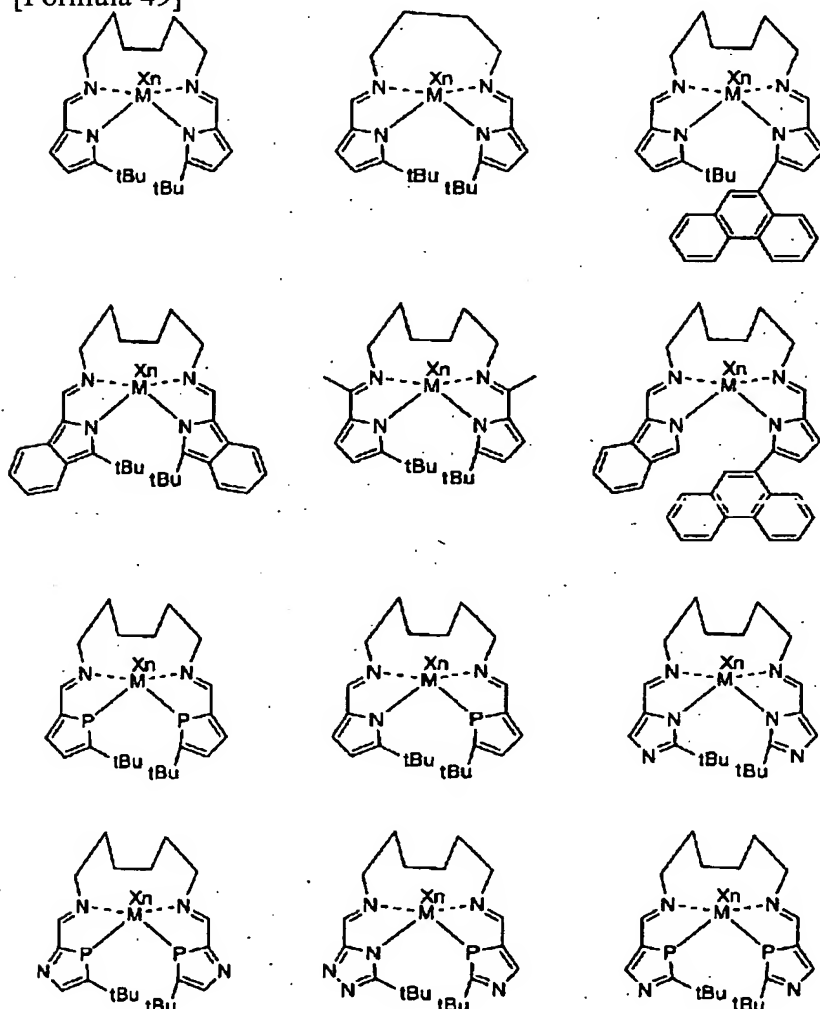
have the substituent.

[0142] As a divalent joint radical (Y'), specifically Chalcogen atom; -NH(s)[, such as -O-, -S-, and -Se-,], - Nitrogen, such as N(CH₃)-, -PH-, and -P(CH₃)-, or Lynn atom content radical; -SiH₂-, - Silicon atom content radicals, such as Si(CH₃)₂-; boron atom content radicals, such as tin atom content radical; -BHs[, such as -SnH₂- and -Sn(CH₃)₂-,], -B(CH₃)-, and -BF-, etc. are mentioned. As a hydrocarbon group, carbon atomic numbers, such as -(CH₂)₄-, -(CH₂)₅-, and -(CH₂)₆-, the saturated hydrocarbon radical of 3-20, Cycloalkane radicals, such as a cyclohexylidene radical and a cyclo hexylene radical, A part of these saturated hydrocarbon radicals 1-10 hydrocarbon groups, a fluorine, Halogens, such as chlorine and a bromine, oxygen, sulfur, nitrogen, Lynn, silicon, a selenium, The radical permuted with hetero atoms, such as tin and boron, benzene, naphthalene, The carbon atomic number in which carbon atomic numbers, such as an anthracene, contain hetero atoms, such as residue of the cyclic hydrocarbon of 6-20, a pyridine, a quinoline, a thiophene, and a furan, is mentioned for the residue of the ring compound of 3-20 etc.

[0143] Although the concrete example of a transition-metals compound expressed with the above-mentioned general formula (IV-b) below is shown, it is not limited to these.

[0144]

[Formula 49]



[0145] In addition, Me shows a methyl group during the above-mentioned instantiation, and Ph shows a phenyl group. In this invention, the transition-metals compound which transposed the titanium metal to metals other than titanium, such as a zirconium and a hafnium, can also be used in the above compounds. Although such a manufacture approach especially of a transition-metals compound (C) is not limited, it makes the compound (ligand precursor) which serves as a ligand, for example when a transition-metals compound (C) is compounded, and transition-metals content

compounds, such as a compound expressed with MX_k (M and X are synonymous with M and X in the above-mentioned general formula (IV), and k is a number which fills the valence of M.), react. [0146] When the ligand which constitutes a transition-metals compound (C) is specifically a pyrrole ARUDO imine ligand, The compound (ligand precursor) which serves as a pyrrole ARUDO imine ligand when a transition-metals compound (C) is compounded The primary amine compound expressed with formula R₁-NH(s)₂, such as an acyl pyrroles compound, and an aniline compound, an alkylamine compound, (however, R₁ is synonymous with R₁ in the above-mentioned general formula (IV).) It is obtained by making it react. An acyl pyrroles compound and a primary amine compound are dissolved in a solvent, and subsequently, if it is reflux conditions and the obtained solution is agitated from a room temperature for about 1 to 48 hours, more specifically, a corresponding ligand precursor will be obtained with good yield. Although a thing general to such a reaction can be used as a solvent used here, hydrocarbon solvents, such as alcoholic solvents, such as a methanol and ethanol, or toluene, are desirable especially.

[0147] Moreover, when the ligand which constitutes a transition-metals compound (C) is a FOSU HORUARUDO imine ligand the acyl FOSU hole compound (Angew Chem 1994 and 106 (11) --) obtained because a ligand precursor formylates for example, a halogenation FOSU hole They are an aniline compound or R₁-NH₂ (however, R₁ is synonymous with R₁ in the above-mentioned general formula (IV).) with the above-mentioned approach about an approach given in 1214. It can obtain by making it react.

[0148] U in the above-mentioned general formula (IV) like a pyrazole ARUDO imine is a carbon atom, A is a nitrogen atom or the Lynn atom, and as well as the above when 5 membered-ring heterocycle compound which has at least one or more nitrogen atoms or the Lynn atoms in Q, S, and T is a ligand, a ligand precursor can be compounded by performing alpha-formylation and imino **.

[0149] When U in the above-mentioned general formula (IV) compounds the ligand precursor which is a nitrogen atom, this ligand precursor can be obtained by making it react with 5 membered-ring hetero compound which has hydrogen in a pyrrole, Indore, a FOSU hole, and an alpha position like a pyrazole, and the diazonium compound compounded from aniline or an alkylamine compound. A corresponding ligand will be obtained, if both start compounds are dissolved in a solvent and the obtained solution is specifically agitated under reflux from 0 degree C for about 1 to 48 hours. As a solvent, aqueous intermediation is desirable.

[0150] A diazonium compound is underwater and is obtained by making the 1st class aniline and an amines compound react with a sodium nitrite, nitrous-acid alkyl, etc. and strong acid, such as a hydrochloric acid. In case a ligand precursor is compounded, the acid catalyst of formic acid, an acetic acid, toluenesulfonic acid, etc. may be used as a catalyst. Moreover, if molecular sieves, magnesium sulfate, or a sodium sulfate is used or it dehydrates by Dean SHUTAKU as a dehydrating agent, it is effective for reaction progress.

[0151] Next, a corresponding transition-metals compound is compoundable by making the ligand precursor obtained in this way react with a transition-metals content compound. The compound ligand precursor can specifically be dissolved in a solvent, and a corresponding transition-metals compound can be compounded by carrying out the direct reaction of the transition-metals content compound. Moreover, a ligand precursor may be contacted to a base if needed, a salt may be prepared, it may mix with metallic compounds, such as a metal halogenide and a metal alkyl ghost, under low temperature, and you may agitate under a room temperature or reflux conditions from -78 degrees C for about 1 to 48 hours.

[0152] Although an ordinary thing can be used for such a reaction as a solvent, hydrocarbon solvents, such as polar solvents, such as the ether and a tetrahydrofuran (THF), and toluene, etc. are used preferably especially. Moreover, as a base used in case a salt is prepared, although organic bases, such as metal salts, such as sodium salt, such as lithium salt, such as n-butyl lithium, and sodium hydride, and triethylamine, a pyridine, are desirable, it is not this limitation.

[0153] Furthermore, it is also possible to exchange the metal M in the compound transition-metals compound for another transition metals with a conventional method. Moreover, when it is H any of R₁-R₅ they are, for example, substituents other than H can be introduced in the phase of composite arbitration. the above transition-metals compounds (C) are independent one sort -- or two or more sorts are combined and it is used. Moreover, it can also use combining the well-known transition-

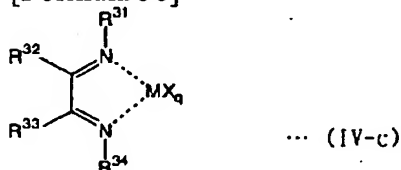
metals compound which consists of a ligand containing hetero atoms, such as transition-metals compounds other than the above-mentioned transition-metals compound (C), for example, nitrogen, oxygen, sulfur, boron, or Lynn.

[0154] Moreover, in addition to the above-mentioned transition-metals compound (C), the titanium catalyst component which uses magnesium, titanium, and a halogen as an indispensable component can be used.

(Other transition-metals compounds) As transition-metals compounds other than the above-mentioned transition-metals compound (C), although the following transition-metals compounds can be used, specifically, it is not this limitation.

[0155] (c-1) The transition-metals imide compound expressed with the following general formula (IV-c) [0156]

[Formula 50]

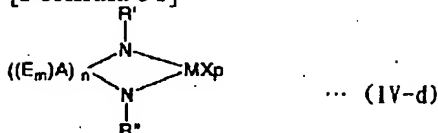


[0157] Among a formula, M shows the transition-metals atom chosen from the 8-10th groups of the periodic table, and is nickel, palladium, or platinum preferably. Even if R31-R34 are mutually the same, they may differ from each other, and they show the hydrocarbon group permuted by the substituent containing at least one sort of atoms chosen from the hydrocarbon group of the carbon atomic numbers 1-50, the halogenated hydrocarbon radical of the carbon atomic numbers 1-50, a hydrocarbon permutation silyl radical or nitrogen, oxygen, Lynn, sulfur, and silicon.

[0158] The radical preferably adjoined of [two or more] these may connect mutually the radical expressed with R31-R34, and it may form the ring. q shows the integer of 0-4. X shows the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical, and even if two or more radicals shown by X when q is two or more are mutually the same, they may differ.

[0159] (c-2) The transition-metals amide compound expressed with the following general formula (IV-d) [0160]

[Formula 51]



[0161] Among a formula, M shows the transition-metals atom chosen from the 3-6th groups of the periodic table, and it is desirable that they are titanium, a zirconium, or a hafnium. Even if R' and R'' are mutually the same, they may differ from each other, and they show the substituent which has at least one sort of atoms chosen from a hydrogen atom, the hydrocarbon group of the carbon atomic numbers 1-50, the halogenated hydrocarbon radical of the carbon atomic numbers 1-50, a hydrocarbon permutation silyl radical or nitrogen, oxygen, Lynn, sulfur, and silicon.

[0162] m is the integer of 0-2. n is the integer of 1-5. The atom chosen from the 13-16th groups of a periodic table is shown, boron, carbon, nitrogen, oxygen, silicon, Lynn, sulfur, germanium, a selenium, tin, etc. are specifically mentioned, and, as for A, it is desirable that they are carbon or silicon. When n is two or more, even if two or more A is mutually the same, it may differ.

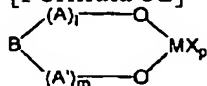
[0163] E is a substituent which has at least one sort of atoms chosen from carbon, hydrogen, oxygen, a halogen, nitrogen, sulfur, Lynn, boron, and silicon. When m is 2, even if two E is mutually the same, it may differ, or it may be connected mutually, and may form the ring. p is the integer of 0-4.

[0164] As for X, the hydrocarbon group of 1-20 and a carbon atomic number show [a hydrogen atom, a halogen atom, and a carbon atomic number] the halogenated hydrocarbon radical, the oxygen content radical, the sulfur content radical, silicon content radical, or nitrogen content radical

of 1-20. In addition, when p is two or more, even if two or more radicals shown by X are mutually the same, they may differ. As for X, it is [among these] desirable that a halogen atom and a carbon atomic number are the hydrocarbon groups or sulfonate radicals of 1-20.

[0165] (c-3) The transition-metals JIFENOKISHI compound expressed with the following general formula (IV-e) [0166]

[Formula 52]



... (IV-e)

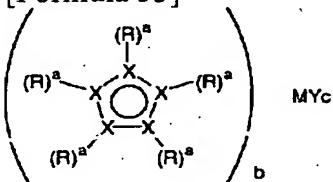
[0167] M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table, l and m are the integers of 0 or 1, respectively, A and A' is a hydrocarbon group with the substituent containing the hydrocarbon group of the carbon atomic numbers 1-50, the halogenated hydrocarbon of the carbon atomic numbers 1-50 or oxygen, sulfur, or silicon, or the halogenated hydrocarbon radical of the carbon atomic numbers 1-50, and even if A and A' is the same, they may differ.

[0168] B is the hydrocarbon group of the carbon atomic numbers 1-50, the halogenated hydrocarbon radical of the carbon atomic numbers 1-50, the radical expressed with R1R2Z, oxygen, or sulfur, R1 and R2 are the hydrocarbon groups of the carbon atomic numbers 1-20 containing the hydrocarbon group of the carbon atomic numbers 1-20, or at least one hetero atom, and Z shows carbon, nitrogen, sulfur, Lynn, or silicon here.

[0169] p is a number which fills the valence of M. X shows the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical, even if two or more radicals shown by X when p is two or more are mutually the same, you may differ, or it may join together mutually, and a ring may be formed.

[0170] (c-4) The transition-metals compound containing the ligand which has a cyclopentadienyl frame containing at least one hetero atom expressed with the following type (IV-f) [0171]

[Formula 53]



... (IV-f)

[0172] M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table. X shows the atom chosen from a periodic table 13th, 14, and 15 groups, and at least one of X is except carbon. a shows 0 or 1. Even if R is mutually the same, it may differ, it shows the hydrocarbon group which has a substituent containing at least one sort of atoms which show a hydrogen atom, a halogen atom, a hydrocarbon group, a halogenated hydrocarbon radical, and a hydrocarbon-group permutation silyl radical, or are chosen from nitrogen, oxygen, Lynn, sulfur, and silicon, and two or more R may connect it mutually, and it may form the ring.

[0173] b is the integer of 1-4, when b is two or more, you may differ, even if a ** [(R) a] 5-X5 radical is the same, and R may be constructing the bridge further. c is a number which fills the valence of M. Y shows the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical.

[0174] When c is two or more, it may join together mutually and two or more radicals which may differ even if two or more radicals shown by Y are mutually the same, and are shown by Y may form a ring.

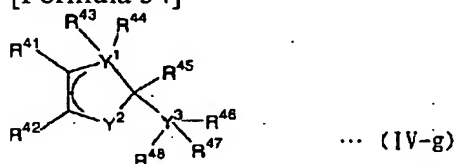
(c-5) General formula RB(Pz)3MXn M shows a periodic table 3 - 11 group transition-metals compound among the transition-metals compound type expressed. R shows the hydrocarbon group of a hydrogen atom and the carbon atomic numbers 1-20, or the halogenated hydrocarbon radical of

the carbon atomic numbers 1-20.

[0175] Pz shows a PIRAZOIRU radical or a permutation PIRAZOIRU radical. n is a number which fills the valence of M. X shows the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical. When n is two or more, even if mutually the same, you may differ, or it may join together mutually, and two or more radicals shown by X may form a ring.

[0176] (c-6) The transition-metals compound shown by the following formula (IV-g) [0177]

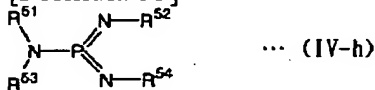
[Formula 54]



[0178] It is the atom which may differ among the formula even if Y1 and Y3 are mutually the same, and is chosen from the 15th group of a periodic table, and Y2 is an atom chosen from the 16th group of a periodic table. Even if R41-R48 are mutually the same, they may differ from each other, they show the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, or a silicon content radical, and among these, two or more pieces may connect them mutually, and they may form the ring.

[0179] (c-7) The compound of the compound expressed with the following general formula (IV-h), and the transition-metals atom chosen from the 8-10th groups of a periodic table [0180]

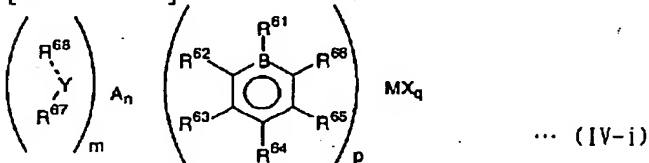
[Formula 55]



[0181] Among a formula, even if R51-R54 are mutually the same, they may differ from each other, and they are the hydrocarbon group of a hydrogen atom, a HAROGE atom, and the carbon atomic numbers 1-20, or the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, and among these, two or more pieces may connect them mutually and they may form the ring.

(c-8) The transition-metals compound shown by the following formula (IV-i) [0182]

[Formula 56]

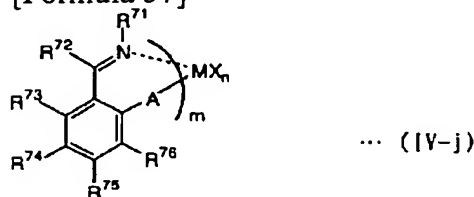


[0183] M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table. m is the integer of 0-3, n is the integer of 0 or 1, p is the integer of 1-3, and q is a number which fills the valence of M.

[0184] Even if R61-R68 are mutually the same, they may differ from each other, they may show the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical, may connect it mutually [two or more pieces] of these, and may form the ring. It may join together mutually and two or more radicals which X shows the hydrocarbon group of a hydrogen atom, a halogen atom, and the carbon atomic numbers 1-20, the halogenated hydrocarbon radical of the carbon atomic numbers 1-20, an oxygen content radical, a sulfur content radical, a silicon content radical, or a nitrogen content radical, may differ even if two or more radicals shown by X when q is two or more are mutually the same, or are shown by X may form a ring.

[0185] Y is a radical which constructs a bridge in the BORATA benzene ring, and shows carbon,

silicon, or germanium. A shows the atom chosen from a periodic table 14th, 15, or 16 groups.
 (c-9) The transition-metals compound expressed with the following general formula (IV-j) [0186]
 [Formula 57]



[0187] M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table. m shows the integer of 1-3. A shows an oxygen atom, a sulfur atom, a selenium atom, or the nitrogen atom that has a substituent R77. You may differ, even if R71-R77 are mutually the same. A hydrogen atom, A halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, A boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. At the time or more of $m = 2$, among R71-R77 which two or more pieces may connect among these, and may form a ring, and are contained in one ligand One radical, One of R71-R77 which are contained in other ligands radicals may be combined, and even if R71 comrades, R72 comrades, R73 comrades, R74 comrades, R75 comrades, R76 comrades, and R77 comrades are mutually the same, they may differ.

[0188] n is an integer with which the valence of M is filled. X shows a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen content radical, a sulfur content radical, a nitrogen content radical, a boron content radical, an aluminum content radical, the Lynn content radical, a halogen content radical, heterocyclic compound residue, a silicon content radical, a germanium content radical, or a tin content radical, and when n is two or more, two or more radicals shown by X may be mutually the same, or may differ.

[0189] Moreover, it may join together mutually and two or more radicals shown by X may form a ring.

(c-10) R shows aliphatic hydrocarbon residue among the vanadium compound type expressed with transition-metals compound (c-11) $VO(OR)_nX_{3-n}$ containing the ligand which has a cyclopentadienyl frame. X shows a halogen atom.

[0190] n is $0 < n \leq 3$.

(D-1) As an organometallic compound used if needed by this invention (D-1), the organometallic compound specifically chosen from following periodic-table the 1st and 2 groups and, and the 12th and 13 groups is used (organometallic compound).

[0191]

(D-1a) general formula Organoaluminium compound expressed with $RaAl(ORb)_nHpXq$ (even when the inside of a formula, and Ra and Rb are mutually the same -- differing -- **** -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably, X shows a halogen atom; $0 \leq p < 3$ and q of $0 \leq n < 3$ and p are $[0 < m \leq 3 \text{ and } n]$ the number of $0 \leq q < 3$, and m is $m+n+p+q=3$).

[0192] (D-1b) general formula ** alkylation object of the 1st group metal of a periodic table and aluminum which are expressed with $M2AlRa4$ (the inside of a formula, and M2 -- Li, Na, or K -- being shown -- Ra -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably.).

(D-1c) general formula Dialkyl compound of the 2nd group of the periodic table to whom it is expressed with $RaRbM3$ (even when the inside of a formula, and Ra and Rb are mutually the same -- differing -- **** -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably, and M3 is Mg, Zn, or Cd.), or the 12th group metal.

[0193] The following compounds etc. can be illustrated as an organoaluminium compound which belongs above (D-1a).

General formula $RaAl(ORb)_3 - m$ (Ra and Rb among a formula) even when it is mutually the same -- differing -- **** -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably, and m is the number of $1.5 \leq m \leq 3$ preferably. organoaluminium compound and general

formula $\text{RaAlX}_3\text{-m}$ (the hydrocarbon group of 1-4 is shown preferably, X shows a halogen atom, and m is $0 < m < 3$ preferably. the inside of a formula, and Ra -- a carbon atomic number -- 1-15 --) expressed The organoaluminium compound, general formula $\text{RaAlH}_3\text{-m}$ (among a formula) which are expressed Ra -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably, and m is $2 \leq m < 3$ preferably. The organoaluminium compound, general formula $\text{RaAl(ORb)}_n\text{X}_q$ (Ra and Rb among a formula) which are expressed even when it is mutually the same -- differing -- **** -- a carbon atomic number -- 1-15 -- the hydrocarbon group of 1-4 is shown preferably, X shows a halogen atom, $0 \leq n < 3$ and q of $0 < m \leq 3$ and n are the number of $0 \leq q < 3$, and m is $m+n+q=3$. The organoaluminium compound expressed.

[0194] More specifically as an organoaluminium compound belonging to (D-1a)

Trimethylaluminum, Triethylaluminum, Triisobutyl aluminum, TORIPURO pill aluminum, Tripentylaluminum, trihexyl aluminum, trioctyl aluminum, Tri n-alkylaluminum, such as tridecyl aluminum; Triisopropyl aluminum, Triisobutylaluminum, Tri sec-butyl aluminum, Tri tert-butyl aluminum, Tri 2-methylbutyl aluminum, Tri 3-methylbutyl aluminum, Tri 2-methyl pentyl aluminum, Tri 3-methyl pentyl aluminum, Tri 4-methyl pentyl aluminum, Tri 2-methyl hexyl aluminum, Tri branched chain alkylaluminum, such as Tri 3-methyl hexyl aluminum and Tri 2-ethylhexyl aluminum; Tricyclohexyl aluminum, Tricyclo alkylaluminum, such as tricyclo octyl aluminum; Triphenyl aluminum, Thoria reel aluminum, such as tritoyl aluminum; dialkyl aluminum hydride; $(i\text{-C}_4\text{H}_9)_x\text{Al}(\text{C}_5\text{H}_{10})_z$, such as a diisobutyl aluminum hydride (among a formula, x, and y and z are positive numbers and are $z \geq 2x$.) etc. -- trialkenylaluminum; isobutyl aluminum methoxides, such as TORIISO prenyl aluminum expressed, -- Alkylaluminum alkoxides, such as isobutyl aluminum ethoxide and isobutyl aluminum isopropoxide; A dimethyl aluminum methoxide, Dialkyl aluminum alkoxides, such as diethyl aluminum ethoxide and dibutyl aluminum butoxide; Ethyl aluminum sesquiethoxide, Alkylaluminum sesquialkoxides, such as butyl aluminum sesquibutoxide; The alkylaluminum; diethyl aluminum phenoxide which has the average presentation expressed with $\text{Ra}_2.5\text{aluminum(ORb)}_0.5$ etc. and by which alkoxy ** was carried out selectively, Diethyl aluminum (2, 6-G t-butyl-4-methyl phenoxide), An ethyl aluminum screw (2, 6-G t-butyl-4-methyl phenoxide), Diisobutyl aluminum (2, 6-G t-butyl-4-methyl phenoxide), Dialkyl aluminum ARIROKISHIDO, such as an isobutyl aluminum screw (2, 6-G t-butyl-4-methyl phenoxide); Dimethyl aluminum chloride, A diethylaluminium chloride, dibutyl aluminum chloride, diethyl aluminum bromide, Dialkyl aluminum halide, such as diisobutyl aluminum chloride; Ethylaluminium sesquichloride, Alkylaluminium sesquihalide, such as butyl aluminum sesquichloride and ethylaluminiumsesquibromide; Ethyl aluminum dichloride, propyl aluminum dichloride and butyl aluminum -- a jib -- the alkylaluminum; diethyl aluminum hydride halogenated selectively [alkylaluminum dihalide, such as ROMIDO, etc.] -- Dialkylaluminium hydrides, such as a dibutyl aluminum hydride; An ethyl aluminum dihydrido, Alkylaluminum hydrogenated selectively [others, such as alkylaluminum dihydridos, such as a propyl aluminum dihydrido,]; Ethyl aluminum ethoxy chloride, The alkylaluminum which alkoxy-**(ed) and was halogenated selectively [butyl aluminum butoxy chloride, ethyl aluminum ethoxy bromide, etc.] can be mentioned.

[0195] Moreover (D-1a), the organoaluminium compound which could also use the similar compound, for example, two or more aluminium compounds combined through the nitrogen atom can be mentioned. Specifically, $2(\text{C}_2\text{H}_5)_2\text{AlN}(\text{C}_2\text{H}_5)_2$ aluminum $(\text{C}_2\text{H}_5)_2$ etc. can be mentioned as such a compound. As a compound which belongs above (D-1b), $\text{LiAl}(\text{C}_2\text{H}_5)_4$, $\text{LiAl}(\text{C}_7\text{H}_{15})_4$, etc. can be mentioned.

[0196] Moreover, in addition to this as an organometallic compound (B-1), methyl lithium, an ethyl lithium, a propyl lithium, butyl lithium, methyl magnesium bromide, methyl magnesium chloride, ethyl magnesium bromide, ethyl magnesium chloride, propyl magnesium bromide, propyl magnesium chloride, butyl magnesium bromide, butyl magnesium chloride, dimethyl magnesium, diethyl magnesium, dibutyl magnesium, butyl ethyl magnesium, etc. can also be used.

[0197] Moreover, combination with a compound with which the above-mentioned organoaluminium compound is formed within a polymerization system, for example, aluminum halide, and alkyl lithium, or the combination of aluminum halide and alkyl magnesium can also be used.

(D-1) In an organometallic compound, an organoaluminium compound is desirable.

The above (D-1) organometallic compounds are one-sort independent, or are combined two or more sorts and used.

[0198] (D-2) The organic aluminum oxy compound used if needed by this invention (D-2) may be an organic aluminum oxy compound of benzene insolubility which may be well-known aluminosilicate and is conventionally illustrated by JP,2-78687,A (organic aluminum oxy compound).

[0199] Conventionally, well-known aluminosilicate can be manufactured by the following approaches, and is usually obtained as a solution of a hydrocarbon solvent, for example.

(1) How to add organoaluminum compounds, such as trialkylaluminum, to hydrocarbon medium suspension, such as the salts containing the compound containing the water of adsorption, or water of crystallization, for example, a magnesium chloride hydrate, a copper-sulfate hydrate, an aluminum-sulfate hydrate, a nickel-sulfate hydrate, and the 1st cerium hydrate of chlorination, and to make the water of adsorption or water of crystallization, and an organoaluminum compound react to it.

(2) How to make direct water, ice, or a steam act on organoaluminum compounds, such as trialkylaluminum, in media, such as benzene, toluene, ethyl ether, and a tetrahydrofuran.

(3) How to make organic stannic-acid ghosts, such as dimethyl tin oxide and dibutyltin oxide, react to organoaluminum compounds, such as trialkylaluminum, in media, such as Deccan, benzene, and toluene.

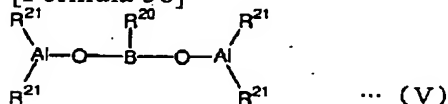
[0200] In addition, this aluminosilicate may contain a little organic metal component. Moreover, after distilling and removing a solvent or an unreacted organoaluminum compound from the collected solution of the above-mentioned aluminosilicate, a solvent may be made to suspend in the poor solvent of remelting or aluminosilicate. Specifically, the same organoaluminum compound as what was illustrated as an organoaluminum compound which belongs above (D-1a) can be mentioned as an organoaluminum compound used in case aluminosilicate is prepared.

[0201] Trialkylaluminum and tricyclo alkylaluminum are desirable and especially trimethylaluminum is [among these] desirable. The above organoaluminum compounds are one-sort independent, or are combined two or more sorts and used. As a solvent used for preparation of aluminosilicate, hydrocarbon solvents, such as halogenides (a chlorination object, bromination object, etc.) of petroleum fractions, such as alicyclic group hydrocarbons, such as aliphatic hydrocarbon, such as aromatic hydrocarbon, such as benzene, toluene, a xylene, a cumene, and a cymene, a pentane, a hexane, a heptane, an octane, Deccan, a dodecane, hexadecane, and an OKUTA decane, a cyclopentane, a cyclohexane, cyclooctane, and methylcyclopentane, a gasoline, kerosene, and gas oil, or the above-mentioned aromatic hydrocarbon, aliphatic hydrocarbon, and an alicyclic group hydrocarbon, be mentioned. Furthermore, ether, such as ethyl ether and a tetrahydrofuran, can also be used. Aromatic hydrocarbon or aliphatic hydrocarbon is desirable especially among these solvents.

[0202] Moreover, the organic aluminum oxy compound of benzene insolubility used by this invention has that desirable whose aluminum component which dissolves in 60-degree C benzene is usually insolubility or poor solubility 5% or less 10% or less to what [what is 2% or less especially preferably], i.e., benzene, preferably in aluminum atom conversion. The organic aluminum oxy compound which contained the boron expressed with the following general formula (V) as an organic aluminum oxy compound used by this invention can also be mentioned.

[0203]

[Formula 58]



[0204] As for R²⁰, a carbon atomic number shows the hydrocarbon group of 1-10 among a formula. You may differ, even if R²¹ is mutually the same, and a hydrogen atom, a halogen atom, and a carbon atomic number show the hydrocarbon group of 1-10. said general formula (the alkyl boron acid to which the organic aluminum oxy compound containing the boron expressed with V) is expressed with the following general formula (VI), and R²⁰-B-(OH) -- two -- (VI) (R²⁰ shows the same radical as the above among a formula.)

An organoaluminium compound can be manufactured in an inert solvent under an inert gas ambient atmosphere by making it react at the temperature of -80 degrees C - a room temperature for 1 minute to 24 hours.

[0205] As a concrete thing of the alkyl boron acid expressed with said general formula (VI), methyl boron acid, ethyl boron acid, isopropyl boron acid, n-propyl boron acid, n-butyl boron acid, isobutyl boron acid, n-hexyl boron acid, cyclohexyl boron acid, phenyl boron acid, 3, 5-difluoro boron acid, pentafluorophenyl boron acid, 3, and 5-screw (trifluoromethyl) phenyl boron acid etc. is mentioned. In these, a methyl boron acid, n-butyl boron acid, an isobutyl boron acid, 3, a 5-difluoro phenyl boron acid, and a pentafluorophenyl boron acid are desirable. These are one-sort independent, or are combined two or more sorts and used.

[0206] Specifically, the same organoaluminium compound as what was illustrated as an organoaluminium compound which belongs above (D-1a) can be mentioned as such an alkyl boron acid and an organoaluminium compound made to react. Trialkylaluminium and tricyclo alkylaluminum are desirable and especially trimethylaluminum, triethylaluminum, and triisobutylaluminum are [among these] desirable. These are one-sort independent, or are combined two or more sorts and used.

[0207] The above (B-2) organic aluminum oxy compounds are one-sort independent, or are combined two or more sorts and used.

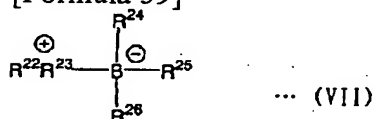
(D-3) The compound which reacts with the transition-metals compound (C) used if needed by compound this invention which reacts with a transition-metals compound and forms an ion pair, and forms an ion pair (D-3) (It is hereafter called an "ionization ionicity compound".) If it carries out, JP,1-501950,A, JP,1-502036,A, JP,3-179005,A, JP,3-179006,A, JP,3-207703,A, The Lewis acid indicated by JP,3-207704,A, USP-5321106 No., etc., an ionicity compound, a borane compound, a carborane compound, etc. can be mentioned. Furthermore, a heteropoly compound and an iso poly compound can also be mentioned.

[0208] Specifically as Lewis acid, it is BR_3 (R). it is the phenyl group or fluorine which may have substituents, such as a fluorine, a methyl group, and a trifluoromethyl radical. The compound shown is mentioned. For example, trifluoro boron, triphenyl boron, Tris (4-fluoro phenyl) boron, tris (3, 5-difluoro phenyl) boron, Tris (4-fluoro methylphenyl) boron, tris (pentafluorophenyl) boron, tris (p-tolyl) boron, tris (o-tolyl) boron, tris (3, 5-dimethylphenyl) boron, etc. are mentioned.

[0209] As an ionicity compound, the compound expressed with the following general formula (VII), for example is mentioned.

[0210]

[Formula 59]



[0211] As R^{22} , H^+ , a carbonium cation, an oxonium cation, an ammonium cation, a phosphonium cation, a cycloheptyltrieryl cation, the ferro SENIUMU cation that has transition metals are mentioned among a formula. even when R^{23} - R^{26} are mutually the same -- differing -- **** -- an organic radical -- they are an aryl group or a permutation aryl group preferably.

[0212] Specifically, 3 permutation carbonium cations, such as a triphenyl carbonium cation, the Tori (methylphenyl) carbonium cation, and the Tori (dimethylphenyl) carbonium cation, etc. are mentioned as said carbonium cation. As said ammonium cation, specifically A trimethylammonium cation, a triethyl ammonium cation, A TORIPURO pill ammonium cation, a tributyl ammonium cation, Trialkylammonium cations, such as a Tori (n-butyl) ammonium cation; N and N-dimethyl anilinium cation, N and N-diethyl anilinium cation, N, and N- an N [, such as 2, 4, and 6-pentamethylanilinium cation,] and N-dialkyl anilinium cation; JI (isopropyl) ammonium cation -- Dialkyl ammonium cations, such as a dicyclohexyl ammonium cation, etc. are mentioned.

[0213] Specifically, thoria reel phosphonium cations, such as an triphenyl phosphonium cation, the Tori (methylphenyl) phosphonium cation, and the Tori (dimethylphenyl) phosphonium cation, etc. are mentioned as said phosphonium cation. As R^{22} , a carbonium cation, an ammonium cation, etc. are desirable and triphenyl carbonium cation, N, and N-dimethyl anilinium cation, N, and N-diethyl

anilinium cation is especially desirable.

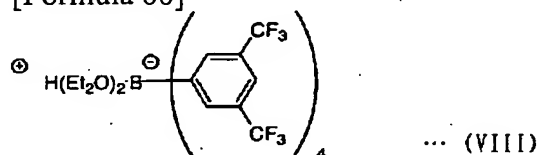
[0214] Moreover, as an ionicity compound, trialkyl permutation ammonium salt, N, and N-dialkyl anilinium salt, dialkyl ammonium salt, a thoria reel HOSUFONIUMU salt, etc. can also be mentioned. As trialkyl permutation ammonium salt, specifically For example, triethyl ammonium tetrapod (phenyl) boron, TORIPURO pill ammonium tetrapod (phenyl) boron, Tori (n-butyl) ammonium tetrapod (phenyl) boron, trimethylammonium tetrapod (p-tolyl) boron, Trimethylammonium tetrapod (o-tolyl) boron, Tori (n-butyl) ammonium tetrapod (pentafluorophenyl) boron, TORIPURO pill ammonium tetrapod (o, p-dimethylphenyl) boron, Tori (n-butyl) ammonium tetrapod (m and m-dimethylphenyl) boron, Tori (n-butyl) ammonium tetrapod (p-trifluoro methylphenyl) boron, Tori (n-butyl) ammonium tetrapod (3, 5-ditrifluoromethyl phenyl) boron, Tori (n-butyl) ammonium tetrapod (o-tolyl) boron, etc. are mentioned.

[0215] as N and N-dialkyl anilinium salt -- concrete -- for example, N and N-dimethyl anilinium tetrapod (phenyl) boron, N, and N-diethyl anilinium tetrapod (phenyl) boron, N, and N- 2, 4, and 6-pentamethylanilinium tetrapod (phenyl) boron etc. is mentioned. II (1-propyl) ammonium tetrapod (pentafluorophenyl) boron, dicyclohexyl ammonium tetrapod (phenyl) boron, etc. are specifically as dialkyl ammonium salt mentioned.

[0216] Furthermore, the boron compound expressed with triphenylcarbeniumtetrakis (pentafluorophenyl)borate, N, and N-dimethyl anilinium tetrakis (pentafluorophenyl) borate, ferro SENTIUMU tetrapod (pentafluorophenyl) borate, triphenyl KARUBENIUMUPENTA phenyl cyclopentadienyl complex, N, and N-diethyl anilinium PENTAFENIRU cyclopentadienyl complex, the following type (VIII), or (IX) can also be mentioned as an ionicity compound.

[0217]

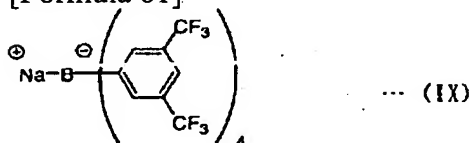
[Formula 60]



[0218] (Et shows an ethyl group among a formula.)

[0219]

[Formula 61]



[0220] As a borane compound, specifically For example, decaborane (14); screw [Tori (n-butyl) ammonium] nona borate, Screw [Tori (n-butyl) ammonium] deca borate, screw [Tori (n-butyl) ammonium] undeca borate, Screw [Tori (n-butyl) ammonium] dodeca borate, screw [Tori (n-butyl) ammonium] deca chloro deca borate, The salt of anions, such as screw [Tori (n-butyl) ammonium] dodeca chloro dodeca borate; Tori (n-butyl) ammonium screw (dodeca hydride dodeca borate) cobalt acid chloride (III), The salt of metal borane anions, such as screw [Tori (n-butyl) ammonium] screw (dodeca hydride dodeca borate) nickel acid chloride (III), etc. is mentioned.

[0221] As a carborane compound, specifically For example, 4-cull BANONA borane (14), 1, 3-JIKARUBA nona borane (13), 6, 9-JIKARUBA decaborane (14), The dodeca hydride-1-phenyl -1, 3-JIKARUBA nona borane, The dodeca hydride-1-methyl -1, 3-JIKARUBA nona borane, undecahydride -1, the 3-dimethyl -1, 3-JIKARUBA nona borane, 7, 8-JIKARUBA undeca borane (13), 2, 7-JIKARUBA undeca borane (13), Undecahydride -7, the 8-dimethyl -7, 8-JIKARUBA undeca borane, The dodeca hydride-11-methyl -2, 7-JIKARUBA undeca borane, Tori (n-butyl) ammonium 1-cull BADEKA borate, Tori (n-butyl) ammonium 1-KARUBA undeca borate, Tori (n-butyl) ammonium 1-KARUBA dodeca borate, Tori (n-butyl) ammonium 1-trimethylsilyl-1-cull BADEKA borate, Tori (n-butyl) ammonium BUROMO-1-KARUBA dodeca borate, Tori (n-butyl) ammonium 6-cull BADEKA borate (14), Tori (n-butyl) ammonium 6-cull BADEKA borate (12), Tori (n-butyl) ammonium 7-KARUBA undeca borate (13), Tori (n-butyl) ammonium 7, 8-dicarba

undecaborate (12), Tori (n-butyl) ammonium 2, 9-dicarba undecaborate (12), The Tori (n-butyl) ammonium dodeca hydride-8-methyl -7, 9-dicarba undecaborate, Tori (n-butyl) ammonium undecahydride-8-ethyl -7, 9-dicarba undecaborate, Tori (n-butyl) ammonium undecahydride-8-butyl -7, 9-dicarba undecaborate, The Tori (n-butyl) ammonium undecahydride-8-allyl compound -7, 9-dicarba undecaborate, Tori (n-butyl) ammonium undecahydride-9-trimethylsilyl -7, 8-dicarba undecaborate, The salt of anions, such as Tori (n-butyl) ammonium undecahydride -4 and 6-dibromo-7-KARUBA undeca borate; Tori (n-butyl) ammonium screw (nona hydride -1, 3-JIKARUBA nona borate) cobalt acid chloride (III), A Tori (n-butyl) ammonium screw (undecahydride -7, 8-dicarba undecaborate) ferrate (III), Tori (n-butyl) ammonium screw (undecahydride -7, 8-dicarba undecaborate) cobalt acid chloride (III), Tori (n-butyl) ammonium screw (undecahydride -7, 8-dicarba undecaborate) nickel acid chloride (III), Tori (n-butyl) ammonium screw (undecahydride -7, 8-dicarba undecaborate) cuprate (III), A Tori (n-butyl) ammonium screw (undecahydride -7, 8-dicarba undecaborate) aurate (III), A Tori (n-butyl) ammonium screw (nona hydride -7, 8-dimethyl -7, 8-dicarba undecaborate) ferrate (III), A Tori (n-butyl) ammonium screw (nona hydride -7, 8-dimethyl -7, 8-dicarba undecaborate) chromate (III), Tori (n-butyl) ammonium screw (TORIBUROMOOKUTA hydride -7, 8-dicarba undecaborate) cobalt acid chloride (III), A tris [Tori (n-butyl) ammonium] screw (undecahydride-7-KARUBA undeca borate) chromate (III), A screw [Tori (n-butyl) ammonium] screw (undecahydride-7-KARUBA undeca borate) manganate (IV), Screw [Tori (n-butyl) ammonium] screw (undecahydride-7-KARUBA undeca borate) cobalt acid chloride (III), The salt of metal carborane anions, such as screw [Tori (n-butyl) ammonium] screw (undecahydride-7-KARUBA undeca borate) nickel acid chloride (IV), etc. is mentioned.

[0222] The heteropoly compound consists of an atom chosen from silicon, Lynn, titanium, germanium, an arsenic, and tin, and one sort or two sorts or more of atoms chosen from vanadium, niobium, molybdenum, and a tungsten. Specifically Lynn vanadium acid, Germano vanadium acid, arsenic vanadium acid, Lynn niobic acid, Germano niobic acid, a SHIRIKONO molybdc acid, molybdophosphoric acid, A titanium molybdc acid, the Germano molybdc acid, an arsenic molybdc acid, a tin molybdc acid, A tungstophosphoric acid, the Germano tungstic acid, a tin tungstic acid, Phosphorus molybdo vanadium acid, a phosphorus tongue SUTOBANAJINN acid, the Germano TANGUSUTOBANAJINN acid, Phosphorus molybdo TANGUSUTO vanadium acid, Germano molybdo TANGUSUTO vanadium acid, On the metal of the salt of a periodic table of a phosphorus molybdo tungstic acid, phosphorus molybdo niobic acid, and these acids, for example, the 1st group, and two groups, and a concrete target Organic salt with a salt with a lithium, sodium, a potassium, a rubidium, caesium, beryllium, magnesium, calcium, strontium, barium, etc., a triphenyl ethyl salt, etc. can be used.

[0223] The above (D-3) ionization ionicity compounds are one-sort independent, or are combined two or more sorts and used. The transition-metals compound concerning this invention shows high copolymerization nature in good activity to an olefin compound, when organic aluminum oxy compounds (D-2), such as methyl aluminoxane, are used as a catalyst and a co-catalyst component. Moreover, if ionization ionicity compounds (D-3), such as triphenyl carbonium tetrakis (pentafluorophenyl) borate, are used as a co-catalyst component, an olefin polymer with high molecular weight will be obtained in good activity. Moreover, support (E) which is later mentioned if needed with the above-mentioned transition-metals compound (C), an organometallic compound (D-1), an organic (D-2) aluminum oxy compound, and (D-3) at least one sort of compounds (D) chosen from an ionization ionicity compound can also be used for the catalyst for olefin polymerization concerning this invention.

[0224] ((E) support) (E) support used if needed by this invention is an inorganic or organic compound, and is a solid-state of the shape of granularity or a particle. Among these, as an inorganic compound, a porosity oxide, an inorganic halogenide, clay, a clay mineral, or an ion-exchange nature stratified compound is desirable.

[0225] As a porosity oxide, specifically SiO₂, aluminum 2O₃, MgO, ZrO, The composite or mixture containing these, such as TiO₂ and B-2s O₃, CaO, ZnO, BaO, and ThO₂, For example, nature or permutite, SiO₂-MgO, SiO₂-aluminum 2O₃, SiO₂-TiO₂, SiO₂-V₂O₅, SiO₂-Cr 2O₃, SiO₂-TiO₂-MgO, etc. can be used. What uses SiO₂ and/or aluminum 2O₃ as a principal component is [among

these] desirable.

[0226] In addition, even if the above-mentioned inorganic oxide contains carbonates, such as little Na_2CO_3 , K_2CO_3 , CaCO_3 and MgCO_3 , Na_2SO_4 , aluminum $_2(\text{SO}_4)_3$, BaSO_4 , KNO_3 , $\text{Mg}(\text{NO}_3)_2$ and aluminum $(\text{NO}_3)_3$, Na_2O , K_2O , and Li_2O , the sulfate, the nitrate, and the oxide component, it does not interfere. 10-300 micrometers of particle size are 20-200 micrometers preferably, and, as for the support by which such a porosity oxide is preferably used for this invention although the description changes with a class and processes, it is desirable to be in the range of 100-700 m^2/g preferably, and for specific surface area to be in 50-1000 m^2/g and the range whose pore volume is 0.3-3.0 cm^3/g . 100-1000 degrees C of such support are preferably calcinated and used at 150-700 degrees C if needed.

[0227] As an inorganic halogenide, MgCl_2 , MgBr_2 , MnCl_2 , and MnBr_2 grade are used. An inorganic halogenide may be used as it is, and after a ball mill and a vibration mill grind, it may be used. moreover, after dissolving an inorganic halogenide in solvents, such as alcohol, what deposited 4s ** in the shape of a particle can also be used for a deposit agent.

[0228] Clay is usually constituted considering a clay mineral as a principal component. Moreover, two or more layers are the compounds which have the crystal structure mutually piled up to parallel by the weak coupling force by ionic bond etc., and the ion-exchange nature stratified compound used by this invention has the exchangeable ion to contain. Most clay minerals are ion-exchange nature stratified compounds. Moreover, as these clay, a clay mineral, and an ion-exchange nature stratified compound, not only a natural thing but an artificial compost can also be used.

[0229] Moreover, the ionic crystal nature compound which has the crystal structure of the shape of a layer, such as clay, a clay mineral and a roppo minute packing mold, an antimony type, CdCl_2 mold, and CdI_2 mold, can be illustrated as clay, a clay mineral, or an ion-exchange nature stratified compound. As such clay and a clay mineral, a kaolin, a bentonite, kibushi clay, Gairome clay, an allophane, a HISHINGERU stone, pyrophyllite, a micaceous group, A montmorillonite group, a vermiculite, a chlorite group, a palygorskite, A kaolinite, nacrite, dickite, halloysite, etc. are mentioned. As an ion-exchange nature stratified compound Alpha-Zr(HAsO_4) $_2$ and H_2O , alpha-Zr(HPO_4) $_2$, alpha-Zr(KPO_4) $_2$ and $3\text{H}_2\text{O}$, The crystalline acid salt of polyvalent metal, such as alpha-Ti(HPO_4) $_2$, alpha-Ti(HAsO_4) $_2$ and H_2O , alpha-Sn(HPO_4) $_2$ and H_2O , gamma-Zr(HPO_4) $_2$, gamma-Ti(HPO_4) $_2$, and gamma-Ti(NH_4PO_4) $_2$, H_2O , etc. is mentioned.

[0230] A thing 0.1cc [$/\text{g}$] or more has desirable pore volume with a radius of 20A or more measured with the method of mercury penetration, and such clay, a clay mineral, or an ion-exchange nature stratified compound has especially a 0.3-5cc [$/\text{g}$] desirable thing. Here, pore volume is measured by the method of mercury penetration which used the mercury porosimeter about the range of 20 to 3x104A of pore radii.

[0231] When what has pore volume with a radius of 20A or more smaller than 0.1 cc/g is used as support, there is an inclination for high polymerization activity to be hard to be acquired. To clay and a clay mineral, it is also desirable to perform a chemical treatment. All can use the surface treatment which removes the impurity adhering to a front face as a chemical treatment, the processing which affects the clayey crystal structure. Specifically, acid treatment, alkali treatment, salts processing, organic substance processing, etc. are mentioned as a chemical treatment. Acid treatment removes a surface impurity, and also increases surface area by making cations in the crystal structure, such as aluminum, Fe, and Mg, eluted. In alkali treatment, the clayey crystal structure is destroyed and change of clayey structure is brought about. Moreover, in salts processing and organic substance processing, ion complex, a molecular complex, an organic derivative, etc. can be formed, and surface area and the distance between layers can be changed.

[0232] an ion-exchange nature stratified compound -- ion-exchange nature -- using -- the exchangeable ion between layers -- another big ** -- you may be a stratified compound in the condition that between layers was expanded, by exchanging for high ion. such ** -- high ion is bearing the role supporting the layer structure like a stanchion, and is usually called a pillar. Moreover, it is called intercalation to introduce another matter between the layers of a stratified compound in this way. As a guest compound which carries out an intercalation TiCl -- four -- ZrCl -- four -- etc. -- a cation -- a sex -- an inorganic compound -- Ti -- (-- OR --) -- four -- Zr -- (-- OR --) -- four -- PO -- (-- OR --) -- three -- B -- (-- OR --) -- three -- etc. -- a metal -- an alkoxide (R is a

hydrocarbon group etc.) -- [-- aluminum -- 13 -- O -- four -- (-- OH --) -- 24 --] -- seven -- + -- [-- Zr -- four -- (-- OH --) -- 14 --] -- two -- + -- [-- Fe -- three -- O (OCOCH₃) -- six --] -- + -- etc. -- a metal -- the hydroxide ion -- etc. -- mentioning -- having . These compounds are independent, or are combined two or more sorts and used. moreover -- these -- a compound -- an intercalation -- carrying out -- the time -- Si -- (-- OR --) -- four -- aluminum -- (-- OR --) -- three -- germanium -- (-- OR --) -- four -- etc. -- a metal -- an alkoxide (R is a hydrocarbon group etc.) -- etc. -- hydrolyzing -- having obtained -- a polymerization -- an object -- SiO -- two -- etc. -- colloid -- an inorganic compound -- etc. -- living together -- it can also make . Moreover, as a pillar, after carrying out the intercalation of the above-mentioned metal hydroxide ion between layers, the oxide generated by carrying out heating dehydration is mentioned.

[0233] Clay, a clay mineral, and an ion-exchange nature stratified compound may be used, after using as it is and processing a ball mill, sieving, etc. Moreover, addition adsorption of the water is newly carried out, or you may use, after carrying out heating dehydration processing. Furthermore, it may use independently or you may use combining two or more sorts. A desirable thing is clay or a clay mineral among these, and especially desirable things are a montmorillonite, a vermiculite, a PEKUTO light, a TENIO light, and synthetic mica.

[0234] As an organic compound, particle-size can mention the granularity or the particle-like solid-state in the range which is 10-300 micrometers. Specifically, carbon atomic numbers, such as ethylene, a propylene, 1-butene, and 4-methyl-1-pentene, can illustrate the polymer generated considering the polymer generated considering the alpha olefin of 2-14 as a principal component (**), or a vinyl cyclohexane, and styrene as a principal component (**), and the conversion object of *****.

[0235] The catalyst for olefin polymerization concerning this invention can also contain a specific organic compound component (F) which is later mentioned with support (E) if needed the above-mentioned transition-metals compound (C), an organometallic compound (D-1), an organic (D-2) aluminum oxy compound and (D-3) at least one sort of compounds (D) chosen from an ionization ionicity compound, and if needed.

[0236] ((F) organic compound component) If needed, (F) organic compound component used if needed in this invention is used in order to raise the physical properties of the polymerization engine performance and a generation polymer. As such an organic compound, alcohols, a phenol nature compound, a carboxylic acid, phosphorus compounds, a sulfonate, etc. are mentioned.

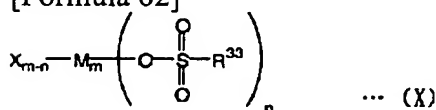
[0237] As alcohols and a phenol nature compound, what is expressed with R31-OH is usually used, and, as for R31, the hydrocarbon group of the carbon atomic numbers 1-50 or the halogenated hydrocarbon radical of the carbon atomic numbers 1-50 is shown here. As for the thing of halogenated hydrocarbon, as alcohols, R31 is desirable. Moreover, as a phenol nature compound, that by which at least alpha of a hydroxyl group and alpha'- were permuted with the hydrocarbon of the carbon atomic numbers 1-20 is desirable.

[0238] As a carboxylic acid, what is expressed with R32-COOH is usually used. R32 shows the hydrocarbon group of the carbon atomic numbers 1-50, or the halogenated hydrocarbon radical of the carbon atomic numbers 1-50, and its halogenated hydrocarbon radical of the carbon atomic numbers 1-50 is especially desirable. As a phosphorus compound, the phosphate which has the phosphoric acid which has P-O-H association, P-OR, and P=O association, and the phosphine oxide compound are used preferably.

[0239] As a sulfonate, what is expressed with the following general formula (X) is used.

[0240]

[Formula 62]



[0241] M is an atom chosen from one to periodic-table 14 group among a formula. R33 is the hydrocarbon group of hydrogen and the carbon atomic numbers 1-20, or the halogenated hydrocarbon radical of the carbon atomic numbers 1-20. A hydrogen atom, a halogen atom, and a carbon atomic number are [the hydrocarbon group of 1-20 and the carbon atomic number of X] the

halogenated hydrocarbon radicals of 1-20.

[0242] m is the integer of 1-7 and n is $1 \leq n \leq 7$. The preparation process of the catalyst used for manufacture of the alpha olefin and annular olefine copolymer applied to this invention at drawing 1 is shown. In the case of a polymerization, although the usage of each component and addition sequence are chosen as arbitration, the following approaches are illustrated.

(1) How to add a component (C) and a component (D) to curing units in order of arbitration.

(2) How to add the catalyst component which supported the component (C) to support (E), and a component (D) to curing units in order of arbitration.

(3) How to add the catalyst component which supported the component (D) to support (E), and a component (C) to curing units in order of arbitration.

(4) How to add the catalyst component which supported the component (C) to support (E), and the catalyst component which supported the component (D) to support (E) to curing units in order of arbitration.

(5) How to add the catalyst component which supported the component (C) and the component (D) to support (E) to curing units.

[0243] The above (1) Beforehand in contact with at least two or more of each catalyst components in the all directions method of - (5). Moreover, the catalyst component may be further supported on the solid-state catalyst component to which precuring of the olefin may be carried out and precuring of the solid-state catalyst component with which the component (C) and the component (D) were supported by the above-mentioned component (E) was carried out.

[0244] By the alpha olefin and the annular olefin copolymerization approach concerning this invention, an alpha olefin and an annular olefine copolymer are obtained by copolymerizing an alpha olefin and an annular olefin under existence of above alpha olefin and catalysts for annular olefin copolymerization. In this invention, a polymerization can be carried out also in any of liquid phase polymerization methods, such as a dissolution polymerization and a suspension polymerization, or a vapor-phase-polymerization method.

[0245] As an inert hydrocarbon medium used in a liquid phase polymerization method, (Polymerization solvent) Specifically A propane, butane, a pentane, a hexane, a heptane, an octane, Deccan, Aliphatic hydrocarbon, such as a dodecane and kerosene; A cyclopentane, a cyclohexane, Alicycle group hydrocarbons, such as methylcyclopentane; Benzene, toluene, Aromatic hydrocarbon, such as a xylene; halogenated hydrocarbon or such mixture; such as ethylene chloride, chlorobenzene, and dichloromethane, etc. can be mentioned, and an alpha olefin and/or the annular olefin itself can also be used as a solvent.

[0246] (Concentration of a catalyst) It faces performing copolymerization of an alpha olefin and an annular olefin using above alpha olefin and catalysts for annular olefin copolymerization, and a component (C) is 10-12 to ten - two mols usually per polymerization volume of 1l. preferably used in an amount which becomes 10-10 to ten - three mols.

[0247] As for a component (D-1), a mole ratio $[(D-1)/M]$ with the transition-metals atom (M) in a component (D-1) and a component (C) is usually used in 0.01-100,000, and an amount that is preferably set to 0.05-50,000. As for a component (D-2), the mole ratio $[(D-2)/M]$ of the aluminum atom in a component (D-2) and the transition-metals atom (M) in a component (C) is usually used in 10-500,000, and an amount that is preferably set to 20-100,000. As for a component (D-3), a mole ratio $[(D-3)/M]$ with the transition-metals atom (M) in a component (D-3) and a component (C) is usually used in 1-10, and an amount that is preferably set to 1-5.

[0248] When a component (D) is a component (D-1), a component (F) When mole ratios $[(F)/(D-1)]$ are usually 0.01-10, and the amount that is preferably set to 0.1-5 and a component (D) is a component (D-2) Mole ratios $[(F)/(D-2)]$ are usually 0.001-2, and the amount that is preferably set to 0.005-1, and when a component (D) is a component (D-3), a mole ratio $[(F)/(D-3)]$ is usually used if needed in 0.01-10, and an amount that is preferably set to 0.1-5.

[0249] (Polymerization temperature and polymerization preassure force) The range of -50-+200 degrees C of polymerization temperature of the olefin using such a catalyst for olefin polymerization is usually 0-170 degrees C preferably again. the polymerization preassure force -- usually -- ordinary pressure - 9.8 MPa (100kg/cm²), it is under the condition of ordinary pressure -4.9MPa (50kg/cm²) preferably, and a polymerization reaction can be performed also in which approach of a batch

process, half-continuous system, and continuous system. It is also possible to divide a polymerization into two or more steps where reaction conditions differ, and to perform it furthermore.

[0250] (Accommodation of molecular weight) The molecular weight of the olefin polymer obtained can be adjusted by making hydrogen exist in a polymerization system, or changing polymerization temperature. Furthermore, it can also adjust by the difference in the component (B) to be used.

(Other monomers) Copolymerization of the polar monomer other than an alpha olefin and an annular olefin may be carried out if needed. As a polar monomer, for example An acrylic acid, a methacrylic acid, a fumaric acid, alpha, such as a maleic anhydride, an itaconic acid, itaconic acid anhydride, the bicyclo (2, 2, 1)-5-heptene -2, and 3-dicarboxylic acid anhydride, beta-unsaturated carboxylic acid, And these sodium salt, potassium salt, lithium salt, zinc salt, magnesium salt, alpha, such as a calcium salt, beta-unsaturated-carboxylic-acid metal salt; A methyl acrylate, An ethyl acrylate, acrylic-acid n-propyl, acrylic-acid isopropyl, Acrylic-acid n-butyl, isobutyl acrylate, acrylic-acid tert-butyl, 2-ethylhexyl acrylate, a methyl methacrylate, ethyl methacrylate, Methacrylic-acid n-propyl, methacrylic-acid isopropyl, n-butyl methacrylate, alpha, such as methacrylic-acid isobutyl, beta-unsaturated-carboxylic-acid ester; Vinyl acetate, Propionic-acid vinyl, caproic-acid vinyl, capric-acid vinyl, lauric-acid vinyl, Vinyl ester, such as stearin acid vinyl and trifluoroacetic acid vinyl; Metaglycidyl acrylate, Halogen content olefins, such as partial saturation glycidyl [, such as glycidyl methacrylate and itaconic-acid monoglycidyl ester,], vinyl chloride, vinyl, etc. fluoride, can be mentioned.

[0251] Moreover, a vinyl cyclohexane, diene, or a polyene can also be used. As diene or a polyene, the compound of the shape of 4-30, annular [that are 4-20 preferably and have two or more double bonds], or a chain is used for a carbon atomic number. Specifically A butadiene, an isoprene, 4-methyl-1,3-pentadiene, 1,3-pentadiene, 1, 4-pentadiene, 1, 5-hexadiene, 1, 4-hexadiene, 1, 3-hexadiene, 1, 3-OKUTA diene, 1, 4-OKUTA diene, 1, 5-OKUTA diene, 1, 6-OKUTA diene, 1, 7-OKUTA diene, ethylidene norbornene, vinyl norbornene, Dicyclopentadiene; The 7-methyl -1, 6-OKUTA diene, the 4-ethylidene-8-methyl -1, 7-nonadiene, 5 and 9-dimethyl - 1, 4, and 8-deca trien; -- further -- an aromatic series vinyl compound -- For example, styrene, o-methyl styrene, m-methyl styrene, p-methyl styrene, o, p-dimethyl styrene, o-ethyl styrene, m-ethyl styrene, Monochrome, such as p-ethyl styrene, or poly alkyl styrene; Methoxy styrene, Ethoxy styrene, a vinyl benzoic acid, vinyl methyl benzoate, vinylbenzyl acetate, Functional-group content styrene derivative [, such as hydroxystyrene, o-chloro styrene, p-chloro styrene, and a divinylbenzene,]; and 3-phenyl propylene, 4-phenyl propylene, alpha methyl styrene, etc. are mentioned. These olefins are independent, or can be combined two or more sorts and can be used.

[0252]

[Effect of the Invention] The alpha olefin and annular olefine copolymer in connection with this invention have the description of molecular weight distribution of being very narrow. Moreover, the alpha olefin and the catalyst for annular olefin copolymerization in connection with this invention can obtain very narrow alpha olefin and annular olefine copolymer of molecular weight distribution in high polymerization activity.

[0253]

[Example] Hereafter, although an example explains this invention, this invention is not limited to these examples. The synthetic example of the complex used for the polymerization is shown below. Structure determination of the 270MHz of the obtained compounds was carried out using ¹H-NMR (JEOL GSH-270), FD-mass analysis (JEOL SX-102A), metal content analysis (it is analysis;SHIMADZU ICPS-8000 after dry incineration and the aqua-fortis dissolution and by the ICP method), etc.

[0254]

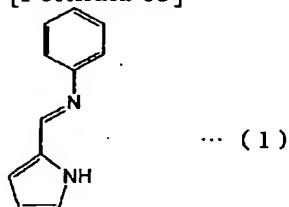
[The synthetic example 1] Composition of a ligand precursor (1): Ethanol 150ml, aniline 5.0g (53mmol), and pyrrole 2-carboxy aldehyde 5.1g (53mmol) were inserted in the 300ml reactor which fully carried out the nitrogen purge, and churning was further continued at the room temperature after adding 1ml of formic acid for 24 hours. 6.0g (34.9mmol, 66% of yield) of white solid-states was obtained by carrying out vacuum concentration of the obtained reaction mixture, removing a solvent and carrying out silica gel column purification. The analysis result of this white solid-state is

shown below.

[0255] $^1\text{H-NMR}(\text{CDCl}_3)$: 6.30 (dd, 1H), 6.69 (d, 1H) and 6.89 (d, 1H), and 7.1- 7.5 (m, 5H), 8.29 (s, 1H), and the 9.85(brs, 1H) FD-mass analysis: 170 above-mentioned result show that a white solid-state is a compound (ligand precursor (1)) shown by the following formula (1).

[0256]

[Formula 63]

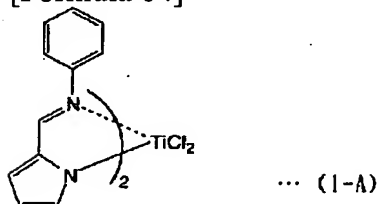


[0257] Composition of a transition-metals compound (1-A): 16ml of diethylether solutions with which 1.04g (1) (6.08mmol) of ligand precursors is contained was fully cooled at -78 degree C in desiccation and the 100ml reactor which carried out the argon permutation, and temperature up of the 4.2ml of the hexane solutions which contain n-BuLi in this solution 6.08 mmols was slowly carried out to the room temperature after dropping. This solution was slowly dropped at the mixed solution (6.08ml (0.5 mmol/ml titanium-tetrachloride concentration) of heptane solutions of a titanium tetrachloride, and diethylether 16ml cooled at -78 degrees C). Churning was continued after dropping termination, carrying out temperature up to a room temperature slowly. After agitating at a room temperature furthermore for 8 hours, this reaction mixture was filtered with the glass filter, vacuum concentration of the filtrate was carried out and the depositing solid-state was dissolved in the methylene chloride at 5ml, and it added slowly, agitating hexane 10ml. The solid-state dark-brown by carrying out room temperature gentle placement of this mixed liquor deposited. This solid-state was carried out the ** exception with the glass filter, and 1.10g (2.40mmol, 79% of yield) of dark brown solid-states was obtained by carrying out reduced pressure drying after washing by the pentane. The analysis result of this dark brown solid-state is shown below.

[0258] $^1\text{H-NMR}(\text{CDCl}_3)$: 6.0-7.9 (m, 16H), 7.80(s, 2H) FD-mass analysis: 456 (M+) elemental analysis : Ti; 10.4% (10.5) () As for inside, the calculated-value above-mentioned result shows that a dark brown solid-state is a compound (transition-metals compound (1-A)) shown by the following formula (1-A).

[0259]

[Formula 64]



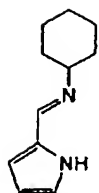
[0260]

[The synthetic example 2] Composition of a ligand precursor (2): Ethanol 150ml, cyclohexylamine 5.22g (52.6mmol), and pyrrole 2-carboxy aldehyde 5.0g (52.6mmol) were inserted in the 300ml reactor which fully carried out the nitrogen purge, cyclohexylamine and a pyrrole 2-carboxy aldehyde were dissolved in ethanol, and churning was continued at the room temperature for 24 hours. 8.88g (50.4mmol, 96% of yield) of dark brown oil was obtained by carrying out vacuum concentration of the reaction mixture, and carrying out solvent clearance and a vacuum drying. The analysis result of this dark brown oil is shown below.

[0261] $^1\text{H-NMR}(\text{CDCl}_3)$: 1.1-1.9 (m, 10H), 3.0-3.2 (m, 1H), 6.21 (dd, 1H), 6.48 (d, 1H), 6.89 (d, 1H), 8.13 (s, 1H), and the 8.35(brs, 1H) FD-mass analysis: 176 above-mentioned result show that dark brown oil is a compound (ligand precursor (2)) shown by the following formula (2).

[0262]

[Formula 65]



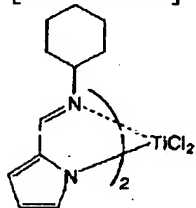
... (2)

[0263] Composition of a transition-metals compound (2-A): Among desiccation and the 100ml reactor which carried out the argon permutation, 25ml of diethylether solutions containing 1.02g (4) (5.78mmol) of ligand precursors was cooled at -78 degree C, and temperature up of the 3.8ml of the hexane solutions which contain n-BuLi 6.08 mmols was fully slowly carried out to the room temperature after dropping. This solution was slowly dropped at 5.78ml (0.5 mmol/ml titanium-tetrachloride concentration) of heptane solutions of a titanium tetrachloride and the diethylether 25ml mixed solution which were cooled at -78 degrees C. Churning was continued after dropping termination, carrying out temperature up to a room temperature slowly. After agitating at a room temperature furthermore for 8 hours, this reaction mixture was filtered with the glass filter, vacuum concentration of the filtrate was carried out and the depositing solid-state was dissolved in the methylene chloride at 5ml, and it added slowly, agitating hexane 10ml. The black solid-state deposited by carrying out room temperature gentle placement of this mixed liquor. This solid-state was carried out the ** exception with the glass filter, and 0.52g (1.1mmol, 38% of yield) of black solid-states was obtained by carrying out reduced pressure drying after washing by the hexane. The analysis result of this black solid-state is shown below.

[0264] $^1\text{H-NMR}(\text{CDCl}_3)$: 0.7-2.7 (m, 22H), 6.28 (dd, 2H), 6.60 (d, 2H) and 7.80 (d, 2H), 8.00(s, 2H) FD-mass analysis: 468 (M⁺) elemental analysis : Ti; 17.8% (17.8) () As for inside, the calculated-value above-mentioned result shows that a black solid-state is a compound (transition-metals compound (2-A)) shown by the following formula (2-A).

[0265]

[Formula 66]



... (2-A)

[0266]

[Example 1] Cyclohexane 235ml was inserted in the glass autoclave of 500ml of content volume which fully carried out the nitrogen purge, and the liquid phase and a gaseous phase were saturated with the ethylene of the flow rate of 50l. / hr. then, this autoclave -- 10g tetracyclo [-- 4. -- the transition-metals compound (2-A) was succeedingly added for 4.0, 12, 5.17, 10]-3-dodecen (it is hereafter written as "TD".), and methyl aluminoxane (MAO) 0.005 mmols 1.25 mmols by aluminum atom conversion, and the polymerization was started. After [which is shown in a table 1 by the bottom 25 degree-C ordinary pressure of an ethylene gas ambient atmosphere] carrying out a time amount reaction, the polymerization was suspended by adding a small amount of isobutyl alcohol. After polymerization termination, the reactant was supplied to the acetone / methanol (respectively 500ml) mixed solvent which added 5ml concentrated hydrochloric acid, and the polymer was filtered with the glass filter after stirring after the whole-quantity deposit. After carrying out reduced pressure drying of the polymer in 130 degrees C and 10 hours, ethylene / TD copolymer was obtained. The result is shown in the following table 1. It was very narrow at molecular-weight-distribution Mw/Mn=1.17.

(1) the molecular weight of the obtained polymer, and molecular weight distribution -- GPC measurement was performed on the following conditions.

[0267] Equipment: GPC Alliance2000 (Waters)

column: -- TSKgel GMH6-HT x 2+TSKgel GMH6-HTLx2 (total 30cmx 4 and TOSOH (CORP.))

detector: -- differential refractometer measurement solvent: -- o-dichlorobenzene measurement flow

rate: -- 1 mL/min measurement temperature: -- 140-degree-C sample injection rate: -- 500microL
 standard-substance: -- mono dispersion polystyrene x16 (TOSOH CORP.)

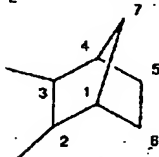
(2) It asked for the annular olefin content by ^{13}C -NMR analysis of the monomer presentation ratio
 ** polymer in the obtained polymer, and the correlation type of Tg by DSC (differential scanning calorimeter) measurement. The annular olefin content was computed using this correlation type from Tg by DSC measurement.

measurement [of the annular olefin content by ^{13}C -NMR]: -- equipment: -- JEOL make EX400
 frequency: -- quantum [of 100.4MHzNB]: -- NB(mol %) = $1/3 \times [2 \times (C7) + (C1, C4) + (C2, C3)] / (C5, C6 \& \text{ethylene}) \times 100$ -- here -- () -- an inner value expresses peak intensity. Respectively, it is C 2 and 3. 44-46.5ppmC 1 and 4 38.5-41ppmC7 30.5-32ppmC5, 6ðylene It is 27 to 30 ppm.

[0268] The number of C (carbon atom) is as in the following drawings.

[0269]

[Formula 67]

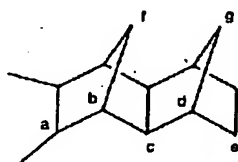
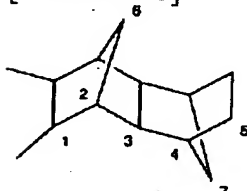


[0270]

quantum of TD TD (mol %) -- = -- (-- TD --) -- /((TD)+(ethylene)) -- x -- 100 -- here -- (-- TD --) --
 = ((3) + (c)) -- / -- two (ethylene) -- = -- [(29.5 to 32.5 ppm) - (-- five --) - (-- e --) - (-- f --) --] -- / --
 two -- = [(29.5 to 32.5 ppm) - (TD) - (c)/2]/2 -- here -- () -- an inner value expresses peak intensity. It
 is C, respectively (3). 51.0ppmC (c) The number of 54.5ppmC (carbon atom) is as in the following
 drawings.

[0271]

[Formula 68]



[0272] Measurement of Tg: Tg of the obtained polymer asked by performing DSC measurement on condition that the following.

Equipment: Shimadzu DSC-60 Measuring condition: Quench the sample held for 5 minutes at 300 degrees C to 0 degree C, and it is a programming rate after that. In the process which carries out temperature up, Tg was calculated to 250 degrees C by 20 degrees C / min.

[0273]

[Examples 2-10] An alpha olefin and annular olefin copolymerization were performed on conditions as shown in a table 1. The result was summarized in a table 1. The alpha olefin and the annular [all] olefine copolymer with narrow molecular weight distribution were obtained.

[0274]

[The examples 1-3 of a comparison] An alpha olefin and annular olefin copolymerization were performed on conditions as shown in a table 2 using the vanadium catalyst (VOCl_3) and the metallocene catalyst (Cp_2ZrCl_2 , $\text{Et}(\text{Ind})_2\text{ZrCl}_2$). The result was summarized in a table 2. The molecular weight distribution of an alpha olefin and an annular olefine copolymer from which it was obtained in any case were the things exceeding 1.8.

[0275]

[A table 1]

表 1

	α -オレフィン/ H_2 流量 (L/h)	環状オレフィン	仕込量 (g)	錯体	重合溶媒	収量 (g)	重合活性	Mn (万)	Mw 10 ⁴ (万)	Mw/Mn	環状オレフィン 含有量 (mol%)
実施例 1	C2/H ₂ =50/0	TD	10	2	C-C6	1.35	811	31.0	36.1	1.17	44
実施例 2	C2/H ₂ =50/0	TD	5	2	C-C6	1.26	754	38.6	46.7	1.21	40
実施例 3	C2/H ₂ =50/5	TD	10	2	C-C6	1.07	641	2.1	3.2	1.55	43
実施例 4	C2/H ₂ =50/10	TD	10	2	C-C6	0.77	463	1.1	1.9	1.64	43
実施例 5	C2/H ₂ =50/5	TD	2.5	2	C-C6	1.19	715	3.1	4.9	1.57	35
実施例 6	C2/H ₂ =50/0	TD	10	1	C-C6	0.20	122	4.4	5.4	1.24	45
実施例 7	C2/H ₂ =50/0	TD	10	2	C-C6	0.82	986	16.3	17.7	1.08	44
実施例 8	C2/H ₂ =50/0	TD	5	2	Tol	3.00	1798	68.1	83.8	1.23	29
実施例 9	C2/H ₂ =50/0	TD	10	2	C-C6	0.720	432	12.8	22.3	1.74	45
実施例 10	C2/H ₂ =50/0	NB	10	2	C-C6	2.79	1676	67.7	87.0	1.28	42

C2 : エチレン、TD : テトラシクロ [4.4.0.1^{4,5}.1^{7,10}] -3-ドデセン、NB : ビシクロ [2.2.1] ヘプト-2-エン

C-C6 : シクロヘキサン、Tol : トルエン、235 mL

錯体の仕込み量 : 0.005 mmol

重合活性の単位 : g-モノ/ mmol-cat · h、環状オレフィン含有量の単位 : mol %

重合温度 : 25 °C (実施例 9 のみ 50 °C)、重合時間 : 20 分 (実施例 7 のみ 10 分)、助触媒 : MAO 1.25 mmol

[0276]

[A table 2]

表 2

	α -オレフィン/ H_2 流量 (L/h)	触媒	収量 (g)	重合活性	Mn (万)	Mw (万)	Mw/Mn	環状オレフィン含有量 (mol%)
比較例 1	C2/H ₂ =50/0	VOCl ₃	0.21	126	10.2	42.5	4.15	34.4
比較例 2	C2/H ₂ =50/0	Co ₂ ZrCl ₂	0.02	12	8.7	18.5	2.12	12.5
比較例 3	C2/H ₂ =50/0	Et(Ind) ₂ ZrCl ₂	0.92	550	31.8	64.0	2.01	11.6

助触媒 : エチルアルミニウムセスキクロライド 1 mmol (比較例 1)、MAO 1.25 mmol (比較例 2、3)

C2 : エチレン

環状オレフィン : TD (テトラシクロ [4.4.0.1^{2,5}.1^{7,10}] -3-ドデセン) 10 g

Co₂ZrCl₂ : ビス (シクロペンタジエニル) ジルコニウムジクロリド

Et(Ind)₂ZrCl₂ : エチレンビス (インデニル) ジルコニウムジクロリド

重合溶媒 : シクロヘキサン、235 mL

触媒の仕込み量 : 0.005 mmol

重合活性の単位 : g-モノ/ mmol-cat · h、環状オレフィン含有量 (環状オレフィン由来の構成単位の含有量) の単位 : mol %

重合温度 : 25 °C、重合時間 : 20 分、

[Translation done.]

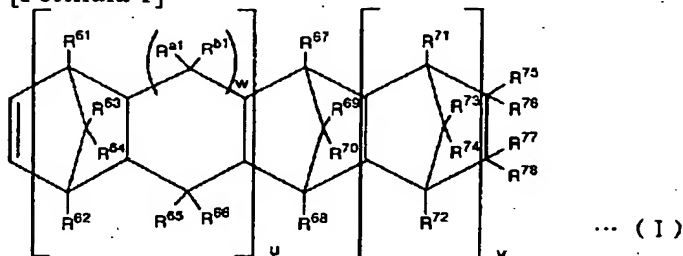
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CLAIMS

[Claim(s)]

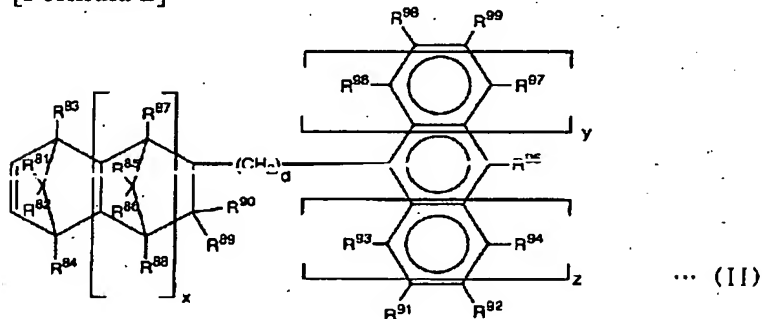
[Claim 1] (A) The configuration unit originating in the alpha olefin of the shape of a straight chain of the carbon atomic numbers 2-30, and the letter of branching, and the (B) following general formula (I)

[Formula 1]



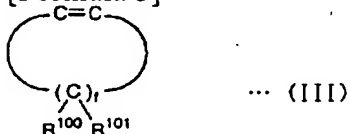
(u is 0 or 1 among a formula (I), v is 0 or a forward integer, and w is 0 or 1. R61-R78, and Ra1 and Rb1) You may differ, even if mutually the same, and they are a hydrogen atom, a halogen atom, or a hydrocarbon group. R75-R78 it may join together mutually, and a monocycle or many rings may be formed, this monocycle or many rings may have the double bond, it is with R75 and R76, or the alkylidene radical may be formed by R77 and R78. The configuration unit, the following general formula (II) originating in the annular olefin expressed

[Formula 2]



(x and d are 0 or one or more integers among a formula (II), and y and z are 0, 1, or 2. R81-R99) The carbon atom which you may differ even if mutually the same, and is a hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an aromatic hydrocarbon radical, or an alkoxy group, and R89 and R90 have combined, With the carbon atom which the carbon atom which R93 has combined, or R91 has combined you may join together through the alkylene group of the direct or carbon atomic numbers 1-3, and R95, R92, or R95 and R99 may be mutually combined at the time of y=z=0, and the aromatic series ring of a monocycle or many rings may be formed. The configuration unit originating in the annular olefin expressed, and the following general formula (III)

[Formula 3]

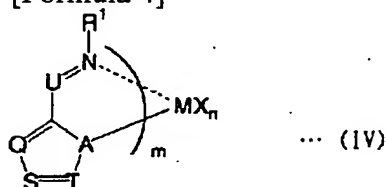


(Among the formula (III), even if R100 and R101 are mutually the same, you may differ.) the

hydrocarbon group of a hydrogen atom or the carbon atomic numbers 1-5 is shown, and f is $1 \leq f \leq 18$. They are the alpha olefin and annular olefine copolymer which consists of at least one sort of configuration units chosen from the group which consists of a configuration unit originating in the annular olefin expressed. (a) The ratio (M_w/M_n) of the weight average molecular weight (M_w) measured with gel permeation chromatography (GPC) and number average molecular weight (M_n) is $1.0 < (M_w/M_n) \leq 1.8$. (b) The configuration unit which the weight average molecular weight (M_w) measured with gel permeation chromatography (GPC) is $1,000 \leq M_w \leq 5,000,000$, and originates in the (c) alpha olefin, The olefin and annular olefine copolymer characterized by a mole ratio (an alpha olefin / annular olefin) with the configuration unit originating in an annular olefin being in the range of 99 / 1 - 20/80.

[Claim 2] A carbon atomic number (A) The alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, (B) The annular olefin expressed with the annular olefin expressed with the above-mentioned general formula (I), and the above-mentioned general formula (II), And the transition-metals compound expressed with the (C) following general formula (IV) in at least one sort of annular olefins chosen from the group which consists of an annular olefin expressed with the above-mentioned general formula (III), (D) (D-1) An organometallic compound, an organic (D-2) aluminum oxy compound, And (D-3) by copolymerizing under existence of the catalyst for olefin polymerization which consists of at least one sort of compounds chosen from the compound which reacts with a transition-metals compound (C) and forms an ion pair The alpha olefin and annular olefine copolymer according to claim 1 characterized by being obtained;

[Formula 4]



(M shows among a formula the transition-metals atom chosen from the 3-11th groups of a periodic table. U) The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R2 is shown. A A nitrogen atom or the Lynn atom is shown and Q shows the carbon atom, nitrogen atom, or the Lynn atom which has a substituent R3. S The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R4 is shown. T The carbon atom, nitrogen atom, or the Lynn atom which has a substituent R5 is shown. m At the time of the transition-metals atom with which the integer of 2-6 is shown, you may differ even if R1-R5 are mutually the same, and M is chosen from the 3-5th groups of a periodic table, and the 7-11th groups A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, At the time of the transition-metals atom with which a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown, and M is chosen from the 6th group of a periodic table R1 A hydrogen atom, a halogen atom, an aliphatic hydrocarbon radical, an alicycle group hydrocarbon group, Heterocyclic compound residue, an oxygen content radical, a nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. R2-R5 A hydrogen atom, a halogen atom, a hydrocarbon group, heterocyclic compound residue, an oxygen content radical, A nitrogen content radical, a boron content radical, a sulfur content radical, the Lynn content radical, a silicon content radical, a germanium content radical, or a tin content radical is shown. R1-R5 One of R1-R5 which may connect mutually [two or more pieces] of these, may form the ring, and are contained in any one ligand radicals A joint radical or single bond may be formed by one of R1-R5 which are contained in other ligands radicals. n It is the number which fills the valence of M. X A hydrogen atom, a halogen atom, a hydrocarbon group, An oxygen content radical, a sulfur content radical, a nitrogen content radical, a boron content radical, an aluminum content radical, The Lynn content radical, a halogen content radical, heterocyclic compound residue, a silicon content radical, a germanium content radical, or a tin content radical is shown, and when n is two or more two or more radicals which may differ even if two or more radicals shown by X are mutually the same, and are shown by X may be

connected mutually, and may form a ring. .

[Claim 3] the above-mentioned alpha olefin -- ethylene -- it is -- the above-mentioned annular olefin -- a bicyclo [2.2.1] hept-2-en and/or tetracyclo [-- 4. -- 4.0.12, 5.17, and the olefin and annular olefine copolymer according to claim 1 or 2 that are 10]-3-dodecen.

[Claim 4] A carbon atomic number (A) The alpha olefin of the shape of a straight chain of 2-30, and the letter of branching, (B) The annular olefin expressed with the annular olefin expressed with a general formula (I) according to claim 1, and a general formula (II) according to claim 1, and at least one sort of annular olefins chosen from the group which consists of an annular olefin expressed with a general formula (III) according to claim 1 -- (C) -- with the transition-metals compound expressed with a general formula (IV) according to claim 2 (D) (D-1) An organometallic compound, an organic (D-2) aluminum oxy compound, And (D-3) the manufacture approach of of the alpha olefin and annular olefine copolymer characterized by copolymerizing under existence of the catalyst for olefin polymerization characterized by consisting of at least one sort of compounds chosen from the compound which reacts with a transition-metals compound (C) and forms an ion pair.

[Claim 5] the above-mentioned alpha olefin -- ethylene -- it is -- the above-mentioned annular olefin -- a bicyclo [2.2.1] hept-2-en and/or tetracyclo [-- 4. -- the manufacture approach of of 4.0.12, 5.17, and the alpha olefin and annular olefine copolymer according to claim 4 that are 10]-3-dodecen.

[Claim 6] The manufacture approach of of an alpha olefin and an annular olefine copolymer according to claim 4 or 5 of manufacturing an alpha olefin and an annular olefine copolymer according to claim 1.

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